FY 2006
Annual Report of Accomplishments and Results

Partnerships Unit
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Submitted by

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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

Under Goal 1, agricultural research at North Carolina A&T State University (NCA&TSU) has three objectives: (a) to increase production and added value of North Carolina farm products, (b) to increase competitiveness and profitability by gaining access to international markets for NC products, and (c) to assist small tobacco farmers in shifting to alternative crop and animal production. Highlights of the FY 2006 are listed and specific accomplishments/impacts are reported under the Key Theme sections below.

Highlights:

- Results from a study conducted on the NCA&TSU Farm show that when winter cover cropping is practiced, similar yields can be obtained from sweet corn at half the recommended nitrogen rate. The implications are that not only can this reduce the cost of corn production, but it can also result in less environmental harm. The project also has shown that specialty melon cultivars Sprite and Sun Jewel could net $2,000 to $4,000 per acre.

- With the use of nanofiltration and ultrafiltration membranes, researchers have developed a system for producing biodegradable plastics from cheese whey, and are now in the process of characterizing the product. The use of biodegradable plastics could significantly reduce pollution and landfill costs associated with plastic packaging materials and provide a value added product for cheese producers.

- An objective of one current study is to develop technologies to convert corn stalks and cheese whey into biofuels and biomaterials including hydrogen, bioethnol, and succinic acid – a chemical used by the pharmaceutical industry. The production of fuels and other materials could create new or value-added crops for farmers and foresters and provide jobs for the rural communities. The use of 10% ethanol blends from renewable resources could also improve air quality and reduce global warming by reducing greenhouse gases (CO2).

- Efforts are continuing in identifying and developing markets in China for North Carolina pork parts that not consumed in the American diet. Small pork producers could benefit greatly from this market.

Total Expenditures: Section 1445 and State Matching Funds = $1,957,763

FTE's: 5.7

1. ***Key Theme – Small Farm Viability***

Description:

Small farms face many challenges in North Carolina. Since the U. S. Congress passed legislation ending the tobacco programs, many small farmers are turning to alternative crops and animal production as a means for being able to continue in the farming business. To assist with this transition, researchers have combined efforts with Extension personnel to identify, test, and demonstrate viable alternatives.

NCA&TSU has experienced success in moving small farmers into mushroom production. Based on the level of production, papers are being filed for North Carolina to be recognized by USDA as having a mushroom industry. This is the direct result of the Edible and Medicinal Mushroom Project led by NCA&TSU with federal, state, and private funding.

Accomplishments/IMPACTS:

- The mushroom production program is providing a viable alternative to tobacco for small farmers in North Carolina. Since this program's inception in 2002, the number of mushroom growers increased to over 375 by March, 2007, representing an increase of 44 percent over the 260 growers in 2006. The number of inoculated logs has increased slightly over 50 percent from 46,251 in 2006 to 69,700 in 2007. Based on average sales of $10 per pound and an average of three pounds per log, the total estimated sales in 2007 is expected to be $2,091,000, resulting in an estimated average annual sales of $5,575 per mushroom grower.

- Since 2001, the NCA&TSU International Trade Center has been providing technical assistance through marketing research on international marketing to Pantego Plantation Gourmet Foods, a minority owned business in North Carolina. The company produces different kinds of bread coating products and bread mixes for cakes, biscuits, pancakes, and hush puppies. Feedback from the company in May indicates that the company had benefited tremendously from the research and assistance in finding markets for their products. As of May 2006, Pantego Plantation Gourmet Foods had increased their exports to Ecuador from zero to 6-8 percent of their annual sales. Despite the export market success, unfortunately, exports have come to a halt due to the political unrest in Ecuador. The International Trade Center is currently researching other trade leads and market opportunities for the company.

Source of Federal Funds: Section 1445, Cooperative Extension, State Matching Funds

Scope of Impact: State Specific

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

1. Overview

The research relating to this goal has focused on determining alternative ways to assure the safety of foods entering the marketplace. Special emphasis this year has been on improving washing methods for reducing microbial activity on fresh green leafy vegetables and improving shelf life from new mushroom packaging technologies. An extract of the pokeweed, found commonly in North Carolina, has proved helpful against poultry infections. We expect impacts from these activities in the future as these innovations are either adopted for commercialization or used by individual producers. These advances are highlighted below.

Highlights:

- The data from one study indicate potential efficacy of pokeweed extract against *Campylobacter jejuni* and Salmonella, which are the leading causes of food borne illness, and suggest that additional research is warranted to determine if similar results occur in floor pens or commercial field studies. This could eventually lead to major reduction in the carrier state of infected broiler chickens entering the processing plant.

- Researchers have developed a new technology regarding the packaging of mushrooms that retards microbial development. A patent has been filed and one major national mushroom company is interested in licensing the technology and is funding additional work by the researchers to measure microbial counts of selected pathogens.

- Research has discovered gaps in food safety knowledge and practices among different population subgroups. Research will be used to inform focused and targeted intervention for maximum effect. The project team disseminated food safety education materials to new and unique target audiences, including food banks patrons, migrant farmer communities (predominantly Hispanic), and immigrant communities, mainly African.

Total Expenditures: Section 1445 and State Matching Funds = $655,264

FTE's: 1.5

1. *Key Theme - Foodborne Pathogen Protection*

Description. Research continues to seek rapid and effective methods to both detect and treat food to protect against foodborne pathogens. At present, there is no conventional

washing method to ensure microbial safety for green leafy vegetables. A simple and effective washing method for produce that can be adapted by small-scale farmers is urgently needed. Campus researchers have shown that the combination of ozone and chlorine dioxide treatment could be an effective and simple method for disinfecting spinach and turnip greens. Current efforts are underway to perfect this approach and move toward commercialization.

Accomplishments/Impacts

- A recent workshop was held with persons attending the Small Farms Week events on the NCA&TSU campus. The workshop presented the ozone technology for treating fresh vegetables—specifically spinach and turnip greens. Of the 16 attending the session, 69 percent reported that they learned new knowledge and about treating fresh vegetables and 75 percent reported that they would very likely use the information in treating vegetables in the future.

Source of Federal Funds: Section 1445; State Matching Funds

Scope of Impact: State specific

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

1. Overview

Many chronic diseases including heart disease, stroke, hypertension, diabetes, and some forms of cancer are related to nutritional factors. The prevalence of some of these chronic conditions is higher among certain ethnic minority groups, including African Americans and Hispanics. While nutritional factors may be related to the incidence of these diseases, there is growing evidence that nutrients may also aid in the prevention and treatment of these conditions. Consequently, U.S. researchers are investigating the use of functional foods and nutraceuticals as means of addressing health problems and promoting good health. Highlights of the FY 2006 are listed and specific accomplishments/impacts are reported under the Key Theme sections below. Also, human health is being improved through the treatment with antibodies produced by a new spin-off company reported in the Accomplishments/Impact section below.

Highlights:

- Research thus far has shown that peanut skins have potent antioxidants with potential as an inexpensive functional ingredient in food or supplements, and/or a food preservative. The project also demonstrated that a high protein, low-fat meat substitute can be developed from defatted peanut flour. These novel uses of peanut industry byproducts could add value to the $75 million farm production industry in North Carolina and to the $4 billion peanut industry in the United States, as well to peanut producers in developing nations.

- Progress thus far suggests that compounds in rosehips may be helpful in cancer prevention and treatment. Crude extracts of rosehips in the test tube significantly reduced the growth and proliferation of colon, breast, and cervical cancer cells. Work is continuing on other plant extracts, including poke weed and bitter kola nut, and a species of Pleurotus mushroom.

- Nationally, the prevalence of age-adjusted combined overweight and obesity is 71.9 percent in Hispanic women. To address this issue, a pilot, 12-week intervention to improve healthy eating and exercise behaviors among Mexican-American women was completed. This intervention provided a unique opportunity for Mexican-American women to participate in a culturally relevant nutrition and physical activity behavioral intervention program, with the aim of improving their overall health. Results from the pilot will be used to develop culturally relevant health programs for Hispanic women.

- Nationally, over 1.5 million American suffer from peanut allergies, and almost half of these persons are children. Food scientists with the Agricultural Research Program recently developed a new process that eliminates the allergenicity of peanuts. Originally these investigators found that fermenting whole or ground peanuts with an edible fungus reduced the detectable level of major allergenic proteins Ara h1 and Ara h2 by as much as 70 percent. This year, NC&ATSU scientists successfully changed to an enzyme process that has totally eliminated the allergens. A patent for this process will be announced soon and several companies are showing interest in licensing the patent.

Total Expenditures: Section 1445 and State Matching Funds = $980,851

FTE's: 3.2

1. ***Key Theme –Human Health***

Description

Research in the development of antibodies can lead to improved human health through effective treatment and diagnosis of diseases. A scientist in the Agricultural Research Program has a long-held patent on a protein that will be used as a diagnostic tool using antibody therapies. The protein is now being commercialized through a spin-off company.

Accomplishments/Impacts

- An animal scientist in the School of Agriculture and Environmental Sciences is leading an effort to commercialize Protein V, his discovery that was patented in 1993. The patent is the first received in the School of Agriculture and Environmental Sciences and at NCA&TSU. The commercialization objective is to use Protein V to purify and isolate antibodies that can be used in a number of

disease treatments and diagnostic applications. This is the first spin-off company at the NCA&TSU and is aimed at the multimillion-dollar industry related to antibody therapies. The application has potential in treating diseases such as Lou Gehrig's Disease, a degenerative nerve disorder that affects two out of very 100,000 Americans.

Source of Federal Funds: Section 1445; State Matching Funds; Capacity Building Grants Program

Scope of Impact: State specific

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

1. Overview

Scientists are seeking ways to improve agricultural practices especially as they affect the environment. Highlights of the FY 2006 are listed and specific accomplishments/impacts are reported under the Key Theme sections below.

Highlights:

- A recently completed study verified that constructed wetlands, when used in conjunction with land application, are effective in treating swine wastewater. Data indicate that by including constructed wetlands in the waste management system, swine farmers can reduce acreage for spray fields and also avoid phosphorus accumulation. The project also indicates that floating wetlands or mechanical aeration will not improve the efficiency of wetlands. This is a long term impact study.

- Separating solids and removing phosphorus from swine wastewater remains a challenge. The goal of this project is to describe an integrated technology based around constructed wetlands that will be appropriate for small to medium swine operators to overcome these and other challenges in treating swine wastewater. The project also will explore a low-tech approach to creating fertilizer from filtered wastewater.

- The Upper Haw River is an important North Carolina waterway that forms part of the Cape Fear River Basin. Water from the river drains to Jordan Lake, a key water supply of Cary and Raleigh residents, and eventually reaches the town of Wilmington, a popular tourist beach spot at NC. This project will determine the applicability of a geo-information system tool, the Soil and Water Assessment Tool (SWAT) for modeling the Haw. If we find that the SWAT is capable of providing a reliable mathematical representation of the hydrology of the river, it can then be used for making predictions about the effects of land use changes on water quality in this region.

- Water pollution of both ground and surface water is a major environmental problem. Some of the most common types of water pollutants are metal ions. Researchers have been investigating using oat hulls which can be converted to adsorbents of metal ions as a means of removing them from wastewater. Conversion of oat hulls, a low-cost, high-volume renewable agricultural by-product, into activated carbons to treat wastewater will increase their value and can contribute to safer drinking water.

Total Expenditures: Section 1445 and State Matching Funds = $546,303

FTE's: 1.5

1. ***Key Theme – Soil Quality***

Description

Soil quality management is important to retain nutrients for plant growth and to ensure desired environmental results. NCA&TSU scientists are conducting experiments that will provide a reliable means for assessing how soil management practices affect soil quality over the short and long term. Long-term projections can then be made of soil quality enhancements that could result from sustainable soil management practices. Another outcome of this project is that recommendations will be made to Piedmont growers on conservation tillage practices and the use of cover cropping and compost.

Accomplishments/Impacts

- A workshop was held for 71 farmers from the Piedmont region of North Carolina to demonstrate cover cropping and no-till practices for plant production. From survey responses of 50 respondents, 70 percent reported that the information was very useful and 98 percent reported that they gained ideas and knowledge that will help their farm be more sustainable. Specifically, 28 percent currently use no-tillage in growing flowers or vegetables and 56 percent reported that they had decided to try no-till methods as the results of information gained during the conference. The results identified that there are important opportunities for improving soil management practices through continued efforts to share pertinent information in this area.

Source of Federal Funds: Section 1445; State Matching Funds

Scope of Impact: State specific

D. *Goal 5: Enhancing economic opportunity and quality of life for Americans*

1. Overview

Efforts at NCA&TSU in the area of Goal 5 focus on expanding economic opportunities for individuals, families, entrepreneurs and communities and fostering the overall quality of life. The focus is on learning more about improving rural economic development, strengthening

leadership development in rural communities, preparing entrepreneurs for successful business ventures, and understanding and recommending improvements in manufactured housing. Highlights of the FY 2006 are listed and specific accomplishments/impacts are reported under the Key Theme section below.

Highlights:

- A completed study suggests that industrial agriculture and hog production have done little to improve economic wellbeing in the Back Belt, and that this region will need to invest resources and effort in attracting other businesses, and assess whether some types of industrialized agriculture such as hog production, have a negative effect on the willingness of other businesses to locate in their communities. The potential impact of the findings is to serve as a source of information for policy makers on rural economic development policy.

- North Carolina has been hard hit by heavy reductions in its traditional industrial base — textiles, apparel, furniture, and paper. In recent years, manufacturing layoffs accounted for 87 percent of job losses in rural counties. Because of the strong likelihood that the decline will continue, rural communities must take steps to attract or develop viable employment alternatives. Defining the factors that impact leadership development could lead to new or improved programs to develop future leaders, and contribute to the sustainability of rural communities.

- An analysis of farm land use found that total acreage of land in agriculture declined in North Carolina by an average of 232,000 acres per year between 2002 and 2006, while the average farm size increased. This decline will likely have a negative impact on North Carolina's economy if the current trend continues. The results were shared with key organizations involved with developing educational materials for current and potential farmers or agricultural policy. Also, the results have led to the enhancement of existing agricultural policy courses and additional graduate and undergraduate courses in agricultural economics.

Total Expenditures: Section 1445 and State Matching Funds = $642,878

FTE's: 2.6

1. ***Key Theme – Impact of Change on Rural Communities***

Description

A major need in rural communities is small business development that can provide jobs and fuel economic development. Training and assistance in developing business plans can lead to viable small businesses in these rural areas.

Accomplishments/Impacts

- Agricultural economists are sharing their expertise in sound business practices by working with non-profit groups to provide a lecture series for minority building contractors to improve their knowledge level and practices. In a series of training sessions held in the eastern part of the North Carolina, a small group of twelve contractors have all indicated through surveys that the information provided is new that they believe will positively affect their business practices. Continued follow-up will continue to determine the continued and actual impact over time.

Source of Federal Funds: Section 1445; State Matching Funds

Scope of Impact: State specific

2. *Key Theme – Promoting Housing Programs*

Description

Over one million North Carolinians live in manufactured homes, accounting for more than 16 percent of the population. Also, the manufactured housing industry contributed $6 billion to the N.C. economy in 2006. A series of studies have focused on improving challenges in the site installation and energy efficiency of these homes. A major impact is being made in the energy efficiency (described below) and a current study is examining the site installation concerns experienced by new manufactured homeowners. The findings of this latter study will be used to provide education to manufactured home owners, and to create a database for housing researchers, from which they will be able to offer suggestions to the industry on improving site installation procedures.

Accomplishments/Impacts

- As a prevalent form of housing in North Carolina, research completed in 2002 focused on a major economic challenge of high operating costs resulting from poor energy efficiency of some units. This research was completed by a team of scientists across campus including the Housing Research component of the Agricultural Research Program. An industry partner with NCA&TSU in the research was Palm Harbor Homes, a major producer of manufactured housing across the nation. NCA&TSU tested various technologies jointly developed in partnership with Palm Harbor Homes, and the results produced more than a 25 % savings over the traditional home regulation by the national code of the U.S. Housing and Urban Development (HUD Code). As a result of the study, Palm Harbor Homes incorporated these technologies into their homes beginning in 2002. The result has been annually savings of over $420,000 for the annual production rate of about 3000 units. This translates into over 10 million Btu/home and about $140 annually in energy cost savings per home. Over the 5-year period since the adoption of these technologies, the research has impacted

over 15,000 households and contributed to over $2 million in savings for these families.

Source of Federal Funds: Section 1445; State Matching Funds;
(Additional Funds: other federal agencies; state agency funds; industry funds)

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 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 School of Agriculture and Environmental Sciences including administrators, researchers, staff, and students. The stakeholders include agriculturally-related industries, agencies, community groups, and county residents.

Agricultural Research Program
The Dean of the School of Agriculture and Environmental Sciences serves as the Research Director and is responsible for ensuring that the School maintains routine contact with consumers associated with the Agricultural Research Program, which includes members of industry, alumni, community groups, and county residents (including under-represented groups. 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 $70 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 for refining and developing the program initiatives of the School.

School of Agriculture and Environmental Sciences Advisory Council
An Advisory Council to the School of Agriculture and Environmental Sciences is composed of representatives from agriculturally-related companies as well as other stakeholders with related interests. The Council meets two times per year 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 School of Agriculture and Environmental Sciences' major program initiatives.

Annual Stakeholder Events

In addition to the formal meetings involving Agricultural Research Program 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. A second major event is the Grassroots Leadership Conference. Administrators and researchers in the Agricultural Research Program participate in these three conferences held annually in the three Extension programming regions of the state (eastern, central and mountains) to listen to the issues, concerns and needs of farmers, community leaders, residents, volunteers, members of the Strategic Planning Council, Specialized Committee members and county and staff persons. These grassroots conferences also assist the Agricultural Program in needs assessment for proposal development, and program priorities. Through these activities, School of Agriculture and Environmental Sciences 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 School of Agriculture and Environmental Sciences research projects.

Feedback is also sought about research and research-related activities by the researchers, their research teams, and by staff associated with Agricultural Research Program and the University; the input is then shared within School of Agriculture and Environmental Sciences 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 food, agricultural and environmental issues. The respondents provide information regarding needs assessments, 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. This information is also shared with the Strategic Planning Council, an advisory board to the campus (NCA&TSU) Cooperative Extension Program. This advisory board is composed of community leaders, agribusiness persons, teaching faculty, Cooperative Extension team members, individuals representing non-governmental organizations, and persons representing under-served and under-represented individuals and groups. The Strategic Planning Council, along with the School of Agriculture and Environmental Sciences Associate Dean for Research, meet to

discuss and use this information in research project reviews, and for Extension planning in response to local and state needs and changes.

Department Level Advisory Boards

Two departments in Ag have main advisory boards, while the remaining two 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 shaping current as well as future activities of the respective department. Their feedback is documented and shared with the faculty, as well as with 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 evolve into research studies are shared with other faculty members, the department chairs, the associate deans, and the Dean. This information is integrated into planning by the School, and is reflected in program initiatives and efforts to address needs, concerns and interests of the diverse audiences served by the Agricultural Research Program. A faculty network that has been institutionalized is the "Industry-Agency Roundtable Breakfast" sponsored by the School of Agriculture and Environmental Sciences 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

Boards and Organizations (continued)

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 School of Agriculture and Environmental Sciences 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 from more formal contractual or written requests.

C. How Stakeholder Input is Processed into Strategic Actions

As described individually under Section A above, the information gathered from the stakeholders is shared with faculty and administrators mainly through face-to-face meetings and reports. The information is used to shape 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.