

FY2000
Annual Report of Accomplishment and Results

Partnerships Unit
Cooperative State Research, Education, and Extension Service
United States Department of Agriculture
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Submitted by

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A. Planned Programs

For the FY2000 reporting period, North Carolina A&T State University will report on Goals 1, 2, 3 and 4. Accomplishments and results were:

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

Overview

- No-till practices, in the soils of the Piedmont region of North Carolina, were more effective in maintaining or increasing crop yield than conventional tillage methods.
 1. Crop growth was greater in soils managed as no tillage and controlled traffic or strip tillage than in conventional tillage soils. Growth was lower in soils managed with no tillage and fully trafficked surfaces compared to soils under no tillage and controlled traffic patterns.
 2. Tillage practices involving no tillage and controlled traffic patterns or strip tillage resulted in grain yield equal to or better than that obtained with conventional tillage. A decrease in grain yield due to soil compaction, resulting from full traffic patterns, was observed in two out of five years.
 3. These results further demonstrate the importance of adopting new technologies, such as controlled-traffic practices in no-tillage.
- 1. Crimson clover and rye mixed cover crops can provide adequate nitrogen for sweet corn and cucumber crops, reducing the input of nitrogen fertilizer and further protecting our water sources from nitrate pollution.
 1. The clover and rye mixture produced a biomass yield of 11 tons/hectare on a dry weight basis.
 2. Sweet corn and cucumber yields were not significantly different between treatments, green manures only versus green manures plus fertilizer.
 3. Sweet corn and cucumber yields, for green manures, were 7.6 and 19.7 tons/ha, respectively. The gross economic values of sweet corn and cucumber were \$6778 and \$14775/ha, respectively.
- 1. Researchers, screening the alfalfa cultivars of *Medicago sativa*, for acid and aluminum tolerance, were able to identify and propagate two cultivars, ALATS 42 and ALATS 43, which hold vast potential for alfalfa and livestock production in Appalachia and other regions where alfalfa is currently not a viable production option.
 1. 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.
 2. The dollar value of tolerant alfalfa would be immense in Appalachia and throughout the world.
- 1. Low-density ovine bone marrow cells were found to prevent the development of peripheral blood lymphocytes as well as release a suppressor factor in culture medium.
 1. Results suggest that ovine endometrial suppressor cells may represent a population of low-density, bone marrow-derived natural suppressor cells, and their trafficking and localization patterns may depend on an ovarian factor(s).

2. Suppressor activity tended to be reversed by a pan-specific neutralization antibody to transforming growth factor-b (TGF-b2); however, the activity was unaffected by a neutralization antibody to TGF-b2.
3. Bone marrow-derived natural suppressor cells may play an important role in the protection of conceptus tissue during early pregnancy.
1. Differential regulation of immunoglobulin ligand binding and Fc receptor expression occurred when lipopolysaccharide (LPS), dexamethasone and sodium butyrate treatments were used to elucidate mechanisms by which Escherichia coli and LPS induced mastitis affect apoptosis of bovine neutrophils.
 1. All treatments were able to regulate cellular levels of protein tyrosine phosphorylation.
 2. These studies, as well as future studies, are aimed at the identification of host factors that augment the functional capacity of bovine neutrophils and enhance resistance of dairy cattle to infection by E. coli, leading to the development of alternatives to antibiotic therapy.
1. A research economist, assessing the competitiveness of U.S. agriculture via the regional research project (S-287), was one of four co-authors of the book, "Competition in Agriculture: The United States in the World Market" and co-author the book's chapter 15 on "Pork Trade Competitiveness."
2. A study assessing how the recent tariff rate quota (TRQ) policy is working within the tobacco industry provided supporting material for testimonials of the North Carolina governor's agricultural policy advisors as well as data for a Master of Science thesis.
3. A study of the textile and apparel industry, to unravel the key policy changes resulting from evolving regional trade policies (such as the NAFTA), has rebuked the often-cited notion that NAFTA may have caused the downturn and key problems in the domestic industry.
1. A producer survey was developed, targeting black farmers, which resulted in a database with names and addresses of over 1500 black farmers in North Carolina.

Source of Funding: Evans-Allen

Total Expenditure: \$1,278,763

Full-time Equivalents: SY = 4.6 PY = 8.1

Key Theme – Agricultural Competitiveness and Profitability

1. Researchers conducted a field study to evaluate the effects of tillage and wheel-traffic compaction in a no-till system on herbicide loss, soil loss, runoff and crop growth under a soybean-corn rotation. 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. Treatments were conventional tillage, strip tillage, no tillage with traffic control and no tillage with a fully trafficked surface.

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

Source of Federal Funds - Evans-Allen

Scope of Impact – State Specific

2. 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 can provide adequate nitrogen for sweet corn and cucumber crops, reducing the input of nitrogen fertilizer and further protecting our water sources from nitrate pollution.

Source of Federal Funds - Evans-Allen

Scope of Impact – State Specific

3. A regional research project (S-256) was established to assess the “competitiveness of U.S. agriculture in the world.” The project’s major objectives were to: a) determine the economic consequences of trade impacts stemming from changes in domestic agricultural and economic policies and to assess alternative strategies to improve the competitiveness of Southern agriculture, and b) determine the economic impacts of continued reforms in trade treaties and agreements and to assess alternative strategies to improve the competitiveness of Southern agriculture.

IMPACT – Publishing of a book entitled “Competition in Agriculture: The United States in the World Market,” and a reassessment (rebuke) of the opinion that NAFTA may have caused the downturn and key problems in the U.S. textile and apparel industry.

Source of Federal Funds - Evans-Allen, USDA National Research Initiative

Scope of Impact – Multistate Research (NC, SC, GA, FL, MS, AR, AL, KY, TX, ND)

Key Theme – Animal Production Efficiency

1. An experimental study was conducted to further elucidate the role of the immune system in early embryonic mortality in ruminant livestock. Fluorescent stained bone marrow (BM) cells of donor lambs were administered to ovariectomized (OVX) ewes, estradiol-treated OVX ewes, intact ewes at estrus, intact ewes on day 14 of the

estrous cycle and to pregnant ewes. Numbers of fluorescent stained bone marrow (BM) cells of donor lambs were quantified within endometrial cell suspension.

IMPACT - Ovine endometrial suppressor cells may represent a population of low-density, bone marrow-derived natural suppressor cells, and their trafficking and localization patterns may depend on an ovarian factor(s).

Source of Federal Funds - Evans-Allen

Scope of Impact – State Specific

2. Research studies were conducted to determine the effect of Escherichia coli and lipopolysaccharide (LPS) induced mastitis on ligand binding, Fc receptor expression, protein tyrosine phosphorylation and mRNA levels and their relationship to apoptosis of bovine neutrophils (PMN). The effect of LPS, dexamethasone, and sodium butyrate treatment on ligand binding, FcR expression and apoptosis of bovine PMN was examined. Further, flow cytometric and western blotting experiments on the effect of these agents on apoptosis and on protein tyrosine phosphorylation of PMN were conducted.

IMPACT - Identification of host factors that augment the functional capacity of bovine neutrophils and enhance resistance of dairy cattle to infection by E. coli will lead to the development of alternatives to antibiotic therapy.

Source of Federal Funds - Evans-Allen

Scope of Impact – State Specific

Key Theme – Biotechnology

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.

IMPACT – Researchers were able to identify and propagate 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.

Source of Federal Funds – Evans-Allen

Scope of Impact – State Specific

Key Theme – Small Farm Viability

A research study was conducted to: a) obtain baseline information on small and minority farmers to design a profile of their characteristics, needs, problems and perceptions, and b) explore, analyze and evaluate the feasibility and risk of alternative practices associated

with the production, marketing, financing, legal, and human resources issues affecting their survival. Researchers queried these farmers about their basic needs, production, marketing and financial problems, and any problems or needs they may encounter accessing the system. Farm enterprise mix, management practices, use of technology, and off-farm employment are factors under investigation as are barriers between farmers and government assistance.

IMPACT – Development of a database of black farmers, complete with names and addresses of over 1500 black farmers in North Carolina.

Source of Federal Funds – Evans-Allen

Scope of Impact – State Specific

Goal 2: A safe and secure food and fiber system

Overview

- Research revealed that approximately 66% of uncooked, whole broiler chickens available at the supermarkets are contaminated with *Campylobacter jejuni*.
 1. Poultry flocks can escape infection when the bedding/litter is changed, good sanitation is practiced and cooler environmental temperatures prevail.
 2. Research studies strongly suggest that both bedding materials and the stress associated with feed withdrawal contribute to the colonization and transmission of *Campylobacter jejuni* in broiler chickens.
 3. Development of intervention strategies would vastly reduce the incidence, as well as devastating effects, of foodborne illnesses associated with the consumption of poultry products contaminated with *Campylobacter jejuni*.
- The use of supercritical carbon dioxide extraction significantly increased the amount of fat extracted from ground beef as temperature and pressure increased.
 1. Oleic acid was the major fatty acid found in the extracted fat followed by palmitic acid.
 2. The proportion of fatty acids detected was not different between 40 and 50°C, although the total amounts of fat (7% more fat at 50°C) extracted were significantly different. Similarly, there was no difference between the extraction pressures of 34.5 and 48.3 Mpa.
 3. Relationships may exist between extraction parameters, such as pressure and temperature, and the amount and composition of fat extracted.
- A rapid procedure for the screening of antimicrobial activities of *Bifidobacterium* species of human isolates was developed through modification of an existing *Bifidobacterium* selective medium (BIM-25 agar).
- 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.

Total Expenditure: \$ 720,170

Full-time Equivalents: SY = 2.8 PY = 4.6

Key Theme – Foodborne Illness

A researcher conducted experiments to determine the effect of different bedding materials on *Campylobacter jenuni* isolation in broiler chickens. Comparisons were

made utilizing pine wood shavings, sand, cedar wood shavings, wheat straw, and corn cobs. Broilers were placed on these materials at 0, 3, and 6 days of age, and sampling began 3 days post placement.

IMPACT - Bedding materials and the stress associated with feed withdrawal possibly contribute to the colonization and transmission of *Campylobacter jejuni* in broiler chickens.

Source of Federal Funds - Evans-Allen

Scope of Impact – State Specific

Key Theme – Food Quality

Freeze-dried ground beef was packed in a one-liter extraction vessel and subjected to fat extraction using a commercial supercritical carbon dioxide extraction system. The extraction temperatures were 40°C and 50°C, the pressures were 34.5, 48.3 and 65.5 Mpa, respectively, and the flow rate was 5 liters/min. The fatty acid profile was studied using gas chromatography.

IMPACT – Relationships may exist between extraction parameters, such as pressure and temperature and the amount and composition of fat extracted, when creating low-fat ground meats.

Source of Federal Funds - Evans-Allen

Scope of Impact – State Specific

Key Theme – Foodborne Pathogen Protection

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.

Source of Federal Funds - Evans-Allen

Scope of Impact – State Specific

Key Theme – Food Safety

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.

Source of Federal Funds - Evans-Allen

Scope of Impact – Multistate Research (VA, NC, SC, GA, FL)

Goal 3: A healthy, well-nourished population

Overview

- Reduced and altered fat table spreads (RAFTS) with high oil contents have the lowest lightness values (darker appearance) and highest b-values (yellowish color), but are easier to spread and have low water activity.
 1. The spreadability of RAFTS is highly correlated with the oil content, yielding the best spreadability ratings among those with medium to high oil content.
 2. Color, texture, flavor and overall desirability were similar among the five commercial brands tested.

Total Expenditure: **\$ 74,431**

Full-time Equivalents: **SY = 0.5** **PY = 0.1**

Key Theme – Human Nutrition

A study was conducted to: 1) evaluate the chemical and physical characteristics of commercial reduced and altered fat table spreads (RAFTS); 2) determine the fatty acid profile of RAFTS; 3) determine RAFTS's stability under simulated storage conditions; and, 4) evaluate the sensory properties of the RAFTS as affected by oil content and storage. Five commercial brands of RAFTS with oil contents ranging from 0 to 70% were purchased from local grocery stores. RAFTS were evaluated for physical characteristics (color, emulsion stability, water activity and spreadability) and sensory properties (color, texture, flavor and overall appeal).

IMPACT – Quantification of trans-fatty acids in commercial reduced and altered fat table spreads (RAFTS) will benefit U.S. consumers who are unable to get dietary information from current product labels.

Source of Federal Funds - Evans-Allen

Scope of Impact – State Specific

Goal 4: Greater harmony between agriculture and the environment

Overview

- With value-added marketing, small-scale pastured pork production may prove to be a practice that favorably compares to tobacco in terms of income generated per acre for small farmers.
- Utilizing 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.
- Treatment of swine waste via a constructed wetland resulted in the removal of nitrogen and phosphorous at the rates of 37 to 51% and 30 to 45%, respectively.
- 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%.

Total Expenditure: **\$ 750,330**

Full-time Equivalents: **SY = 1.5** **PY = 3.9**

Key Theme – Sustainable Agriculture

Research was conducted to: 1) examine the effects of swine maintained on dry lots with or without leaf mulch from October to April; and 2) examine differences in pork quality in market hogs due to diet and management systems. Soil parameters measured from the dry lots included particle-size distribution, soil bulk density, soil porosity, pore-size distribution, saturated hydraulic conductivity, soil water retention, and aggregate stability. Fertility analysis includes soil N (total and inorganic) soil total carbon, soil organic matter, soil pH, zinc content, and copper content. Genetic crosses resulting from a designed breeding scheme will be examined for growth performance and taste differences. Diets will consist of ad-lib feeding of complete ration alone or with free choice pasture or hay, and environments will be indoor, dirt lot or pasture.

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.

Source of Federal Funds - Evans-Allen

Scope of Impact – State Specific

Key Theme – Agricultural Waste Management

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 – Development of bioconversion processes will help to reduce waste treatment cost and add to the profitability of dairy processors.

Source of Federal Funds - Evans-Allen

Scope of Impact – State Specific

Key Theme – 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.

IMPACT - 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.

Source of Federal Funds - Evans-Allen

Scope of Impact – State Specific

B. Stakeholder Input Process

The Agricultural Research Program at North Carolina A&T State University will establish a process for stakeholder input drawing upon three levels of stakeholders. The input process will solicit the views, opinions and recommendations of individuals and

groups from the Business/Corporate, Institutional and Community sectors. Information gathered from the three sectors will be used to identify the emerging issues, both globally and domestically, shaping the future of American agriculture and to help affirm our research priorities.

Our process will address stakeholder input relative to:

- a. Actions taken to seek stakeholder input and encourage participation.
- b. Process used to identify individuals and groups who are stakeholders and how to collect input from them.
- c. How the input was considered in the formulation of our research priorities.

Levels of Input

Methodologies used to collect input data will include surveys, interviews (face-to-face and telephone), focus groups, issues forums and meetings. Regardless of the level at which input is solicited, data will be collected in the most appropriate and effective manner possible.

Business and Corporate Sector

The Dean and Associate Deans of the School of Agriculture and Environmental and Allied Sciences (SAEAS) will play critical roles in the direction and oversight of data collection from the business and corporate sector. Input will be solicited principally through interaction and dialogue with agri-businesses, private industries (small and large companies), commodity groups, federal/state agencies, as well as administrative advisory groups to SAEAS. Two such advisory groups will include the Corporate Roundtable (made up of business executives and managers) and the Dean's Circle (comprised of friends and donors) who have financially supported SAEAS.

Institutional

Various standing councils, committees and taskforces of SAEAS will be solicited to ascertain their insight as to the emerging and researchable issues facing our research programs and target audiences. Through these groups, SAEAS will garner a broad base of perspectives reaching across its teaching, research and extension programs. Faculty will also gather information through their involvement and interaction with agri-businesses, commodity groups, boards, councils, etc., which will be considered in the formulation of our research priorities. Additionally, information will be shared from the North Carolina Cooperative Extension Service's environmental scanning process, which involves community stakeholders from all 100 counties in North Carolina.

Community

Stakeholder input will be gathered locally from farmers, producers, consumers, youth, landowners, homeowners, non-profit organizations (NGOs), etc. relative to SAEAS's mission, goals and programs. Furthermore, information gathered at this level will enable SAEAS to not only quantify the issues and needs of people but also associate a face and name with them. Given the complexity of problems faced by citizens and local

communities, the Agricultural Research and Cooperative Extension programs must create and utilize a multidisciplinary approach to problem solving. Furthering the interaction and integration of academic, research and extension programs within SAEAS is central to enhancing its capacity to conduct research and to react to complex issues facing its constituencies.

C. 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. A supplement was submitted to USDA-CSREES on February 10, 2000.

D. Evaluation of the Success of Multi and Joint Activities

Did the planned programs address critical issues of strategic importance?

Yes, during the FY2000 reporting period, the Agricultural Research Program was engaged in multi-state research activities relative to the use of Evans-Allen funds. Both activities dealt with critical issues of importance. Those activities (projects) were:

- a) **“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.
- b) **“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.

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 which 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.