

2005 Annual Report PLAN OF WORK

State of Delaware

University of Delaware
College of Agriculture and
Natural Resources

Delaware State University
College of Agriculture and
Related Sciences

April 1, 2006

The annual report on the comprehensive
Plan of Work for the
1890 and 1862 Land Grant University
Research and Extension Programs
Serving the Citizens of the State of Delaware

INTRODUCTION

This is the annual report on the Plan of Work for Delaware's research and extension activities, as required by the Agricultural Research, Extension, and Education Reform Act of 1998 (AREERA), and follows the USDA "Guidelines for Land Grant Institution Plan of Work." This report includes the research and extension activities supported by USDA at Delaware State University and the University of Delaware.

Point of Contact

All correspondence regarding this annual report on the Delaware Plan of Work should be directed to:

Robin W. Morgan
Dean and Director
College of Agriculture and Natural Resources
University of Delaware
Newark, DE 19716-2103
Voice: (302) 831-2501
Fax: (302) 831-6758
e-mail: morgan@udel.edu

A. PLANNED PROGRAMS

NATIONAL GOAL 1. AN AGRICULTURAL SYSTEM THAT IS HIGHLY COMPETITIVE IN A GLOBAL ENVIRONMENT

Delaware's economy is so intertwined with the state's billion-dollar poultry industry that a infectious disease breakout could devastate poultry populations and cripple the state's economic base. To protect poultry health, UD researchers employ biotechnology techniques and animal genomics research to unravel the fundamental mechanisms of poultry diseases. This information is used to develop recombinant vaccines that combat current and emerging infectious poultry diseases.

Among the most economically significant pathogens of commercial chickens worldwide is Marek's disease virus, which results in the formation of lymphomas in susceptible chickens. While vaccines for this disease exist, the virus readily mutates, finding new ways to trigger cancer even in vaccinated birds. UD researchers are engaged in a chicken genomics project, the goal of which is to identify expressed genes critical to the immune response to Marek's. Biological clues revealed by the genome will serve as a bridge to new strategies for producing chickens with resistance. Examining the function of genes directly related to infection by the Marek's disease virus may lead eventually to prevention of the disease.

Optimizing poultry health is paramount to profit in the poultry industry. Genomic research at UD improves production, maximizes poultry health and targets broiler growth to correspond with consumer preferences. UD researchers have created normalized cDNA libraries from tissues of

economic importance to the poultry industry, including those related to immunity, growth, and reproduction. The database and clones are used by laboratories worldwide. The information from these studies is useful to breeders focused on optimizing vaccine responsiveness and other desirable production characteristics.

Delaware's first defense for identifying poultry disease is the UD Poultry Diagnostic Laboratory, at which a team of veterinarians and poultry scientists annually examines approximately 1,000 disease cases and tests 25,000 blood samples for antibodies. Poultry is monitored for diseases and the effectiveness of vaccination programs assessed regularly.

A catastrophic poultry disease outbreak such as avian influenza (AI) can have severe economical implications on poultry-producing areas, disrupt exports from the region and country, and may endanger human health. Rapid containment and eradication of this pathogenic disease is critical in minimizing the economic impact to the poultry industry and potential public health risk. UD Extension developed procedures for in-house composting as a biosecure, environmentally sound and cost-effective means for disposal of poultry flocks. Local success in 2004 using in-house composting for containment, inactivation and disposal of AI infected carcasses and litter garnered worldwide attention. Improving response to an outbreak and identifying procedures are under development, including using foam for mass euthanasia. This method greatly reduces biosecurity risk associated with depopulation, and would reduce the labor and human exposure to the virus during depopulation efforts.

UD researchers have developed a new, faster test for tracing sources of infection for a respiratory pathogen known as *Mycoplasma gallisepticum* (MG). The new test provides more epidemiological information in hours, rather than days, thus eliminating the time-consuming and often unsuccessful test results of the past.

In 2005, a trial was conducted to assess the efficacy of using solar-powered LED lighting for broiler growth. The growth rates of poultry grown under solar-powered LED lighting were determined to be not significantly different from poultry grown under conventional lighting. Growers who have switched have realized significant savings to their utility bills.

Poultry is the largest agricultural industry in Delaware, and it faces challenges from urban encroachment in historic agricultural areas. Emissions from modern tunnel-ventilated houses add to neighbor complaints. An Delaware initiative for planting trees as a vegetative environmental buffer (VEB) around the perimeter of poultry houses came out of studies on poultry productivity, trees' ability to capture surface and subsurface nutrients, and their efficacy in filtering airborne pollutants. Dust and ammonia concentrations are reduced by 50 percent with a properly designed vegetative filter. Delaware leads the country in implementation of VEB on poultry farms, and other states are adopting similar programs for poultry and livestock operations. Sustainability of the poultry industry in increasingly urbanized areas such as Delmarva may well depend on widespread implementation of vegetative environmental buffers.

Dairy-animal nutrition studies at UD have led to proven methods for increasing the quality of silage and improving forage that enhances milk production, lowers feed costs, and reduces environmental waste from spoiled silage. Also, since silage spoils readily when exposed to air, a

product that improves the aerobic stability of silage was developed, using research conducted at UD on a silage inoculant containing the bacteria *Lactobacillus buchneri*.

High land costs and the lack of significant examples of aquacultural success are major obstacles in the development of an aquaculture industry in Delaware, deterring potential aquaculturists from entering the arena. Three hundred adults have been introduced to baitfish aquaculture.

Meat goat is being demanded increasingly by U.S. consumers. Much of the goat meat sold here—about 1.5 million pounds of goat meat a week—is imported from New Zealand or Australia. Several major markets are within four hours of Delaware, creating a great opportunity for local, small goat producers to increase profits. In 2005, DSU hosted the *Getting into a meat goat enterprise* workshop.

Innovative options for disease control in plant crops are always being explored. Nationwide, crop loss due to disease is more than \$10 billion annually. Traditional controls, such as agricultural chemicals and chemical control strategies, have become inadequate and are costly in terms of money and the environment. UD scientists are trying to identify the signaling components that underlie disease resistance, which will lead to greater comprehension of the control structure and, in time, control strategies focused on genetically engineered plant resistance.

In 2004, Downy mildew (*Pseudoperonospora cubensis*) infected virtually 100 percent of Delaware's pickling cucumber acreage. Economic loss due to yield reduction and unusable fruit amounted to \$3 million of lost farm income. Conventional fungicides and genetically resistant varieties provided no control. Recommendations for preventative control applications based on research from other regions were disseminated to the Delaware and Delmarva. When the disease reappeared in commercial fields, controls and practices set forth by extension resulted in higher yields and improved quality from 2004, restoring \$3 million in farm income.

Spinach is grown in Delaware for both fresh-market and processing use. Although spinach production is highly mechanized, current harvesting methods that use reciprocating cutter bars are costly to own and operate. The problems associated with current harvesting methods plague spinach growers and processors. Downtime for repair can delay harvest, resulting in poor quality spinach for processors. A new continuous band saw blade cutter was developed. As designed, the new cutter, which can be retrofitted onto existing towed harvesters, is capable of harvesting more spinach at higher rates for less cost than current methods. Harvesting rates as high as 1.3 hectares per hour (compared to 0.8 with the old harvesting system) have been achieved.

The strong local demand for pole lima beans, a niche-market vegetable, makes it a profitable vegetable to grow in Delaware. With an increasing number of small farms growing this vegetable, DSU's Small Farms Program has planted an educational demonstration plot of heirloom pole lima beans at the Smyrna Outreach and Research Center to teach local farmers how to profit on a few acres.

Since the price of traditionally grown crops have made it impossible for most small farmers to continue working their land, small-market vegetables are being used to sustain small farms. The strong demand for locally grow vegetables creates an opportunity to increase small farmers'

profits by using high tunnels to extend the vegetable growing season in Delaware. After hosting high tunnel workshops, six farmers planned to add high tunnels to their operations. Two farmers purchased and constructed high tunnels on their land within two months of completing the course.

Understanding how soil microbes influence the ups and downs in crop production is key to designing microbial-control strategies for crop improvement. Many crop plants in the legume family establish a symbiotic relationship with soil microbes called rhizobia, resulting in the development of a new plant organ, the nitrogen-fixing root nodule. Within these nodules, bacteria reduce atmospheric nitrogen into a form that can be used by the host plant. This form of nitrogen minimizes the amount of chemical fertilizers required for productive crop growth. Improving the ability of crop plants to exploit this “natural” source of nitrogen will lower the direct cost of crop production for farmers as well as reduce the long-term deleterious effect of chemical fertilizers on the environment.

Yield losses from pest infestations can range from 10 to 20 percent because of improper sampling and timing of pesticide applications and improper selection of pest control strategies. To improve agricultural profitability and agricultural competitiveness, dissemination of timely information about pest outbreaks is sent out in a *Weekly Crop Update* newsletter distributed throughout the production season. This commercial management tool enhances agricultural profitability and benefits the environment.

Alfalfa is the most important forage species in the U. S., grown on 8,957,790 hectares in 2005 and producing 66,981,043 metric tons of forage. The tarnished plant bug not only feeds on alfalfa, but is also a pest of more than half of the 30 most important crops in the U.S. It has been brought under control in areas north of New York City by *Peristenus digoneutis*, a nymphal parasite. Unfortunately, this species has not yet affected populations of tarnished plant bug south of New York City. If the tarnished plant bug can be brought under control biologically, it will save food and fiber producers an estimated 350 million dollars annually.

A major pest, the gypsy moth is the most important forest and shade tree pest in northeastern United States. Efforts of this long-term project are to adapt virus strains and formulations, with or without enhancing agents, for use by arborists, nurserymen and people living in urban communities using ground equipment. Improving biological methods for controlling gypsy moth will protect the environment from chemical sprays and introduce long-term biological control into gypsy moth populations; thus, enhancing quality of life in urban communities and society as a whole. This research has contributed to zero spraying of forests in Delaware from 1999 through 2005, thus, saving taxpayers in Delaware \$2,000,000 (\$30.00 per acre) annually. When looking at the impact on adjoining states with gypsy moth populations, the savings are much greater. There savings are approaching the \$10,000,000 figure.

Small RNAs are critical regulators of genes in plants and animals, but most remain unidentified. Identification is the first step toward determining function. UD investigators have identified 77,000+ small RNAs, more than 10 times the number identified previously using a model plant system. Researchers worldwide can access this data via the Web, and examine the function of these small RNAs. Most importantly, the same approach can be used to identify small RNAs in

other systems such as crop plants and humans. This will provide basic knowledge that can be used to develop strategies for crop improvement and the treatment of disease.

Delaware grain farmers generate about \$100 million dollars annually in the sale of soybeans, corn, wheat and barley. Timing is everything when selling grain crops for the highest price in the marketplace. UD Extension specialists have put together an historical basis record for grain and soybeans in Delaware, which grain growers can access via the Web. Since market prices are always changing, this report helps to track trends for greatest profit.

White-tailed deer are overabundant in Delaware and Maryland, which impacts farmers and results in damage to agronomic crops exceeding \$100 million annually. Hunter effort and harvest restrictions do not prevent population reduction to levels considered tolerable. Identifying the time when deer damage has the greatest impact on yield will allow repellent application to be timed for maximum benefit. This research will provides a basis for application timing and the amount of a field that must be treated, thus increasing the feasibility of chemical repellents for reducing deer damage to agronomic crops.

The total expenditures by source of funds and FTE's for goal 1 are:

Hatch Act Funds	\$549,476
Smith-Lever Act Funds	\$221,537
State Matching Funds	\$780,969
Full-Time Equivalents	37.7

NATIONAL GOAL 2. A SAFE AND SECURE FOOD AND FIBER SYSTEM

The contamination of soils and water with metals such as nickel, zinc, and cobalt is of great concern because of their injurious effects on plants, animals, and human health. UD soil scientists continue to discover new ways to reduce the toxicity of metals. Researchers have found that metal (Zn and Ni) hydroxide precipitates form in field soils under conditions of higher metal contents and soil pHs that exceed 6.5. The formation of these precipitates isolates the metals, enhances binding, diminishes leaching, and reduces the bioavailability of the metal. This will ensure that remediation efforts are more effective and less costly.

Culinary herbs and essential oils continue to be one of the premier programs at Delaware State University. Claude E. Phillips Herbarium and Herb Research Center at DSU analyzes both living plants, dried botanicals, and essential oils to help small farmers, manufacturers and distributors of herbs who have no means of certifying their products as safe. DSU's unique combination of botanical and chemical facilities assures quality food and other products. A national collection scheme of living herbs has been started to not only preserve materials but also to provide correctly labeled herbs to gardeners, farmers, nurseries, and researchers. DSU is also a primary source of information on herbs and nomenclature for a worldwide audience, including manufacturers of dietary supplements and other food products.

Delaware's Nutrient Management Act requires that agricultural waste management practices be developed in poultry-producing areas that are "high" in phosphorus and a potential threat to surface and shallow ground waters. UD researchers have conducted studies that provide scientific justification for these regulations, specifically rapid, accurate soil test methods that can predict when soils are sufficiently saturated with phosphorus to be of environmental concern.

Poultry litter is frequently applied to Delaware farmland in regions of intensive poultry production. As a result, large quantities of phosphorous and arsenic are in the soil. While phosphorous occurs naturally in litter, arsenic is a poultry-feed additive used for disease control. UD researchers are working to understand the stability, mobility and toxicity of phosphorous. UD researchers find that soluble phosphorous is reduced with the addition of alum and that the phosphorous is in an adsorbed phase, which is desirable in terms of minimizing phosphorous mobility. In addition, it is encouraging that there is no large build up of arsenic in Delaware soils.

Irrigation consumes large amounts of water and energy and, if poorly managed, can adversely affect the environment. Competition for high-quality water resources for other uses, such as municipal and recreational, has put pressure on irrigated agriculture to manage water resources. Relatively small reductions in water can mean large savings. With a savings of just one half an inch of irrigation water over a season, the grower could realize more than 13,000 gallons per acre—that's 500,000 gallons for a typical 40- acre irrigated field.

The total expenditures by source of funds and FTE for goal 2 are:

Hatch Act Funds	---
Smith-Lever Act Funds	\$212,523
State Matching Funds	\$226,966
Full-Time Equivalents	21.0

NATIONAL GOAL 3. A HEALTHY, WELL-NOURISHED POPULATION

While low-resource families with young children can depend upon the UD EFNEP program to help them improve their families' diets, encourage good lifelong eating habits, and employ smart shopping and budgeting practices, single low-resource youths were overlooked until the initiation of Extension's "Boning up on Health," a series of classes that emphasized the importance of daily calcium consumption and exercise.

Delaware's rate of diabetes is one of the highest in the nation; more than one in 20 Delawareans has been diagnosed with this disease. Proper nutrition and meal planning help control diabetes. Sound nutritional programming that increases knowledge of healthy food choices and cooking techniques is offered through the UD *Dining with Diabetes* program. In 2003, ten *Dining with Diabetes* programs were held in Delaware, reaching 206 participants statewide: 96 white, 34 African American, four Native American and three Latino attendees.

Childhood obesity has become an epidemic in the U.S. Increasing pressures on teachers to focus on math, science and reading skills has left nutrition and physical activity and wellness lessons to

be fit in, if at all, in a very small amount of time. Most of the food messages that children get from television and other media are for high sugar, high fat foods. While some school districts have more financial resources to address these issues, children in low-income schools (where 50% or more of children are eligible for free or reduced price lunches) are more likely to be exposed to messages for foods with low nutrient density.

Through the Power of Choice program, DSU taught youth participants to improve their health by incorporating healthier foods and more exercise into their daily regimens. This instruction taught the participants how to make better food choices. Children reported that they increased their daily consumption of fruits and vegetables, ate breakfast more often, recognized the value of eating more meals as a family, and were more willing to engage in a physically challenging activity.

Food safety is an issue of primary concern for restaurants and commercial and noncommercial food service operations. In-depth employee training is needed to better protect against foodborne illness. For the past seven years, UD Extension educators have offered the ServSafe® Manager Certification Course. Participants have come from a range of facilities that offer food service, including restaurants, state facilities, nursing homes and child care providers. Participants are employed as chefs, restaurant managers and front-line employees. If food safety education helps an establishment avoid even just one foodborne illness outbreak, it saves that operation \$75,000.

The total expenditures by source of funds and FTE's for goal 3 are:

Hatch Act Funds	---
Smith-Lever Act Funds	\$221,233
State Matching Funds	\$243,356
Full-Time Equivalents	7.7

NATIONAL GOAL 4. AN AGRICULTURAL SYSTEM THAT PROTECTS NATURAL RESOURCES AND THE ENVIRONMENT

A catastrophic poultry disease outbreak such as avian influenza can have severe implications to poultry-producing areas such as Delmarva by disrupting exports from the region and posing a potential human health concern. Rapid and effective eradication of this pathogenic disease is critical in minimizing the economic impact to the poultry industry and potential public health risk.

February 2004 when avian influenza (AI) threatened the entire Delmarva broiler industry, fast action on the parts of UD Poultry Diagnostic Laboratory in close collaboration with state agriculture authorities and the Delmarva Poultry Industry to heighten existing biosecurity measures. Containing the virus was a coordinated effort by poultry scientists at the universities of Delaware and Maryland, the Delaware Department of Agriculture, the Delmarva Broiler Industry and USDA Veterinary Services.

When the UD Poultry Diagnostic Center identified two AI-infected flocks in northern Sussex County, the lab went into immediate “lock-down mode,” and scientists worked around the clock

for a week to test the 50 commercial flocks within a five-mile radius of the initial infected flock. The two infected flocks were destroyed and disposed of by UD’s Extension poultry specialist in accordance with industry biosecurity. A patent-pending euthanasia procedure using foam is currently under development—a procedure that could greatly reduce biosecurity risk associated with depopulation and reduce the labor and human exposure to the virus during depopulation efforts.

The total expenditures by source of funds and FTE’s for goal 4 are:

Hatch Act Funds	\$351,904
Smith-Lever Act Funds	\$208,378
State Matching Funds	\$566,393
Full-Time Equivalents	16.5

NATIONAL GOAL 5. ENHANCED ECONOMIC OPPORTUNITY AND QUALITY OF LIFE FOR AMERICANS

While mile-a-minute weed (*Polygonum perfoliatum* L.) is widely distributed in Asia, it is not considered a noxious species there. Accidentally introduced in a nursery in Pennsylvania in the 1930s, this alien species has since become established in the northeast from Virginia to New York and west to Ohio. Its annual vines grow rapidly to form dense mats that can out-compete and displace native plant species. Because of its rampant growth, undesirability, and limited control options, *P. perfoliatum* has been targeted by the U.S. Forest Service for biological control. UD entomologists are studying the host range of insects that feed on mile-a-minute weed in China. One stem-boring weevil, *Rhynoncomimus latipes*, has been shown to be host-specific to *P. perfoliatum*. Short-term monitoring suggests success on a limited level.

If at-risk children and youth in limited-resource communities are to become productive adult citizens, they need to learn resilience. UD Extension has been working with community residents in three low-resource communities throughout Delaware to assess needs and strengths, develop resources and implement customized programs to reduce developmental risks.

UD Extension workshops in financial management, which target low-resource adults, help foster greater financial literacy in topics such as basic money management, debt reduction, educated consuming, and saving for the future.

Lack of adult supervision for latch-key youth after school creates an environment in which negative, life-altering behaviors can flourish during the critical hours of 3 p.m. to 6 p.m. each day. In an effort to educate students, change negative behaviors and allow underserved and under represented students the chance to succeed, the Delaware State University 4-H program has begun after school programs in various faith-based and community housing establishments.

Some Delawareans are financially over-extended because of job loss, easy access to credit, divorce, or the loss of an earning family member. UD Extension offers a financial management education program called *Doing More With Less* geared to social workers, clergy, teachers and others who work with clientele mired in perpetual money problems. *Doing More With Less* is an intensive approach to basic financial management and counseling techniques.

Ecologists now rank invasion by alien species second only to habitat loss as a major threat to biodiversity. “Plants for a Livable Delaware” is a project to educate consumers about invasive plants being sold at retail outlets and taking over public parks and public gardens. To educate consumers learn about the dangers to native flora from to invasive species, a guide to 10 invasive plants that are destroying natural lands but still bought and sold in Delaware was developed with recommended alternatives to invasive species.

Delaware’s Office of Child Care Licensing requires child care providers to attend 30 hours of in-service training yearly. UD Extension provides up-to-date, affordable training for childcare providers with monthly programs for family- and center-based childcare providers in each county. Topics include car seat safety, nutrition, discipline, food safety, and how to work with problem parents.

Volunteerism is a core value of 4-H, and Delaware 4-Hers serve a critical need volunteering in their communities. Delaware 4-H conducted three two-week-long day camps that focused on service learning for campers in 6th through 8th grades. Community service activities included work at the Food Bank, Read Aloud Delaware, renovation of a barn in a state park, Earth Day promotion, Make A Difference Day, Coastal Clean-up and food drives. The average number of volunteer hours provided by 4-Hers at a rate of \$8/hour would mean that they contributed more than \$165,600 worth of services last year.

UD programs aimed at ecosystem balance focus on the maintenance of biodiversity in natural ecosystems in ways that are compatible with agriculture and with urban/suburban population growth and development. Program components include developing and delivering integrated pest management programs—a systems approach using chemical, cultural, mechanical, and biological control to increase net profits to producers while protecting the environment. The expansion of integrated pest management into processing vegetables, melons, potatoes and ornamentals has led to the refinement of disease and mite management programs in watermelons and other crops.

Roadside rights-of-way are notorious for allowing the rapid spread of invasive exotic plant species that threaten native vegetation. UD’s ongoing collaborative research project with DelDOT and the Delaware Center for Horticulture has planted 34 pilot sites along Delaware roadsides to study methods of establishment, species evaluation, maintenance strategies and economics. The pilot plots have provided information for a design and concept manual to be used by DelDOT that will stipulate roadside vegetation in any new or renovation road project.

The total expenditures by source of funds and FTE’s for goal 5 are:

Hatch Act Funds

Smith-Lever Act Funds	\$658,539
State Matching Funds	\$781,755
Full-Time Equivalents	16.9

B. STAKEHOLDER INPUT PROCESS

In the State of Delaware, the University of Delaware and Delaware State University used a multi-faceted approach to securing stakeholder input for the original Plan of Work. We believe in direct contact with people and attempt to solicit input from a wide variety of clientele, users, and stakeholders. Opportunities for input include, but are not limited to, the following: extension overall advisory committees, extension issue-based advisory committees, strengthening families statewide advisory committee, 4-H volunteers, 4-H Foundation, LINKS, agriculture commodity groups, environmental interests, the green industry, agri-businesses, agriculture associations (i.e., Farm Bureau, Grange, Pork Producers Association, Delmarva Poultry Industry, Soybean Board, Sheep Producers Association, etc.), Master Gardeners, Master Food Educators, and Master Financial Planners. We hold a variety of regular meetings across the state, which include a diverse mix of clientele, users, and stakeholders. These meetings include such things as: Delaware Herb Growers Association (DHGA), American Herbal Products Association (AHPA) and American Botanical Council (ABC), Agriculture Visiting Committee, State Chamber of Commerce, Kids County Advisory Council, Delaware Public Policy Institute Task Force, Friends of Agriculture Breakfast series, Council of Farm Organizations, USDA Food and Agricultural Council, State Agriculture Technical Committee, and user groups like 4-H regular and day camp parents. Students enrolled in our colleges, faculty, professionals, and salaried staff, are all encouraged to provide input on program priorities. We have conducted random surveys of users and non-users of the programs and activities on a variety of issues including land use and economic development. Other tools that we use to get input include visioning processes and focus groups.

These efforts have been focused on both building commitment and getting input from stakeholders such as, government agencies, industry partners, and regulatory agencies. Our programs have expanded, and input continues to increase. We are recognized as a source of not only useful but also reliable information. We will continue to seek input in a variety of ways. These methods will change as the issues themselves change.

C. PROGRAM REVIEW PROCESS

Peer Review of Research Programs

We adopt by reference the [National Standards for Peer Review](#).

Merit Review of Extension Programs

Merit review for Delaware Cooperative Extension consists of five levels of peer and stakeholder review. Extension professionals submit county plans that have been reviewed by their peers within the county and by county stakeholder advisory groups. These stakeholder groups provide

input on critical needs and issues within their communities, which is used to develop the county plans. After county plans are complete, stakeholders review them for inclusion of the previously identified needs and issues as well as program delivery and evaluation methodologies. Each of these plans includes specific objectives that are examined for relevance, usefulness, and potential impact of the programs. This feedback is used to refine county plans and develop future plans.

The second level of review is by college-wide issue teams that are cross-functional and multi-disciplinary. From this review, county plans are combined into a college-wide five-year plan.

The third level of review is both within and outside the university community. Copies of the plan are submitted to university administrators and related agency personnel who function as both present and future partners. These individuals are invited to comment on the objectives identified, areas of collaboration, and potential impacts. University administrators are also asked to comment on ways in which we might work across colleges and schools to increase our outreach efforts.

A fourth level is with statewide stakeholder groups, including advisory groups, commodity organizations, volunteers, research partners, state and local funders, etc. These groups are asked to provide feedback regarding objectives, potential impacts, and how it meets their specific needs.

The final level is the Northeast Extension directors, who have agreed to share all state plans among each other. This peer review helps the states advise each other on opportunities to strengthen individual state plans and ways that we can collaborate across state lines.

D. EVALUATION OF THE SUCCESS OF MULTI AND JOINT ACTIVITIES

Delaware State University and the University of Delaware have participated in numerous programs and projects that are multi-state, multi-institutional, multi-disciplinary, and joint research and extension programs. Sections E, F, and G highlight a few of the successful programs. All twelve program areas in the Delaware Plan of Work involve some multi-state and joint activities.

The planned programs were identified through the stakeholder input process as described in section B. Program evaluations and surveys are being used annually to ensure that the planned programs are still on track and relevant to the needs of the state and region.

Attracting underserved and underrepresented populations is a continuing challenge. During the civil rights audit of the Extension programs in Delaware, several suggestions were made on how to attract more underrepresented groups. The response to the civil rights audit has been submitted to CSREES and the report emphasizes the steps being taken to ensure that we exercise “all reasonable efforts.”

In sections E, F, and G the outcomes and impacts of joint and multi programs are described. These outcomes and impacts are consistent with the description in the Plan of Work.

Delaware State University and the University of Delaware have a tradition of multi-state, multi-institutional, and joint activities. These programs have been effective and efficient in the past and continue to accomplish their goals. We share faculty with the University of Maryland, combined the dairy herds of Rutgers and Delaware, and participate in region-wide crisis management programs for beekeepers and stone fruit growers.

Further evaluation of planned programs including outcomes and impacts are presented in Sections E, F, and G.

E. INTEGRATED EXTENSION AND RESEARCH

At UD, research and Extension are closely aligned in efforts to provide Delaware producers with information they can put to use. The following examples are highlights of this collaboration, which also can be found in other goal sections of this report.

For Delaware's billion-dollar poultry industry, the economic damage caused by infectious poultry diseases could be devastating. Using biotechnology techniques and animal genomics research to unravel the fundamental mechanisms of poultry diseases, UD researchers develop recombinant vaccines that combat current and emerging infectious diseases in poultry, thus preventing catastrophic losses. In an outreach effort, UD Poultry Diagnostic Laboratory monitors for diseases in poultry and assesses the effectiveness of vaccination programs.

Plant health is critical to soybean growers, and two new potentially yield-reducing plant diseases have been identified in Delaware: sudden death syndrome in soybeans and wheat streak mosaic virus. Knowing that these diseases are present allows UD scientists and Extension to mount research and educational efforts to prevent these plant diseases from becoming serious problems for Delaware growers.

UD researchers have evaluated the effect of chemical treatment of poultry litter with alum (aluminum sulfate) on phosphorus mobility. Their findings supply critical information for this important broiler-growing region concerning fate, transport, and bioavailability of toxic metals and contaminants, enabling Extension to offer growers scientifically sound and cost-effective strategies.

UD researchers conducted field trials on farms throughout Delaware to demonstrate the value of "starter" fertilizer on corn across soils with a wide range of initial soil test phosphorus levels, to show the value of poultry litter applied at various rates, and to demonstrate the value of diagnostic tools for better nutrient management during crop production. UD Extension's long-term goal is to increase Delaware farmers' awareness of the economic value of poultry litter as a source of nutrients in crop production, thus minimizing the environmental problems associated with over-application of poultry litter to cropland.

F. MULTI-STATE EXTENSION ACTIVITIES

UD Extension often reaches across state lines to Extension staff at other universities for a wider distribution of information. These states include all those on Delmarva (DE, MD, VA) as well as

PA and NJ. The following examples of multi-state Extension activities touch on some of these programs, which also may be contained in other goal sections of this report.

Farm business management skills are taught through programs of the Northeast Center for Risk Management Education (serving New England states, New York, New Jersey, Pennsylvania, Maryland, West Virginia, and Delaware). This center was established at the University of Delaware to educate producers of agricultural products about the range of risk management opportunities available to them in order to maintain profitable businesses.

MAAREC (Mid-Atlantic Apiculture Research & Extension Consortium) is a five-state consortium (DE, MD, NJ, PA, and WV) of university research/Extension, state regulatory and beekeeper associations, charged with keeping bee colonies healthy, thus meeting regional pollination demands, and ensuring agricultural profitability.

Coordinated research and data gathering by the Southeast Pennsylvania IPM group (which UD Extension participates in) has allowed Extension specialists to pinpoint proper monitoring windows for a number of ornamental insect pests.

To reduce loss from crop insects, weeds and diseases, Extension and researchers from the University of Delaware, the University of Maryland/College Park, Rutgers University, and Virginia Tech collaborate each year on comprehensive Pest Management Recommendation Guides for regional field crops and for vegetable crops. Based on data derived from university trials, the information is specific to local climate, soils and conditions, comparing the effectiveness of treatments for specific weed, insect, and crop diseases.

The Mid-Atlantic Crop Management School is an excellent example of a multi-state (Delaware, Maryland and West Virginia) and multi-agency (university, NRCS, and Department of Agriculture) program that provides new educational information. Designed to provide continuing educational opportunities for Certified Crop Advisers, Nutrient Management Consultants, agency personnel (NRCS, Conservation Districts, and Cooperative Extension), independent consultants, and growers, the school provides valuable, applied information to improve incomes in farm and rural communities.

UD Extension and Rutgers University share a herd of 300 cows: 200 heifers and 100 milking cows. UD maintains a milking herd and heifers are raised at Rutgers until just before first calving. The reason for combining the herds is better and more efficient use for teaching, Extension outreach and ruminant nutrition studies.

G. MULTI-STATE RESEARCH

DSU and the University of Delaware participate in numerous multi-state research projects in support of our State Plan of Work. To of these projects: the Claude E. Phillips Herbarium and NC228, Avian Respiratory Diseases: Pathogenesis, Surveillance, Diagnosis and Control.

The Claude E. Phillips Herbarium has a 110,000-specimen vascular plant collection from around the world, some of which date back to 1799, 2500 volumes dating back to 1737, and numerous

periodicals and photographic slides. The herbarium cooperates with many federal, state, and private institutions, including the Natural Resource Conservation Service, the Delaware Department of Natural Resources and Environmental Control, the Delaware Nature Society, the Herb Society of America, and The International Herb Association. This resource is available to students, farmers, public service agents, members of the scientific community, and the public.

The goals of NC228 are to determine the pathogenesis and interactions of specific avian respiratory disease agents, determine the occurrence and consequences of agent and host variation on disease susceptibility, and develop new and improved methods for the diagnosis, prevention, and control of avian respiratory agents. Delaware scientists are sequencing the *Mycoplasma synoviae* genome and studying the relationship between attenuation and intracellular invasiveness for mycoplasma species. In addition, Delaware scientists have examined differences among infectious bronchitis isolates and have been able to better understand the derivation of emerging isolates of this important and costly pathogen.

Participants in NC228 are located in Alabama, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Maryland, Minnesota, North Carolina, and Ohio.

**U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Multi-state Extension Activities and Integrated Activities**

Institution: University of Delaware

State: Delaware

**Check one: Multi-state Extension Activities
 Integrated Activities (Hatch Act Funds)
 Integrated Activities (Smith-Lever Act Funds)**

Title of Planned Program/Activity	Actual Expenditures				
	FY 2001	FY 2002	FY2003	FY2004	FY 2005
<i>Goal 1: An agricultural system that is highly competitive in a global environment</i>	149,977	238,720	168,383	175,270	180,528
<i>Goal 2: A safe and secure food and fiber system</i>	11,044	17,578	12,399	13,999	14,418
<i>Goal 3: A healthy, well-nourished population</i>					
<i>Goal 4: An agricultural system that protects natural resources and the environment</i>	85,605	136,258	96,111	101,000	99,910
<i>Goal 5: Enhanced economic opportunity and quality of life for Americans</i>	68,465	108,977	76,868	77,149	79,310
Total	315,091	501,533	353,761	367,418	374,166

**Robin W. Morgan
Director**

**April 1, 2006
Date**

Form CSREES-REPT (2/00)

**U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Multi-state Extension Activities and Integrated Activities**

Institution: University of Delaware
State: Delaware

Check one: **Multi-state Extension Activities**
 Integrated Activities (Hatch Act Funds)
 Integrated Activities (Smith-Lever Act Funds)

Title of Planned Program/Activity	Actual Expenditures				
	FY 2001	FY 2002	FY2003	FY2004	FY 2005
<i>Goal 1: An agricultural system that is highly competitive in a global environment</i>	305,551	314,717		379,770	324,158
<i>Goal 2: A safe and secure food and fiber system</i>					
<i>Goal 3: A healthy, well-nourished population</i>					
<i>Goal 4: An agricultural system that protects natural resources and the environment</i>	19,162	20,736	465,264	20,143	20,747
<i>Goal 5: Enhanced economic opportunity and quality of life for Americans</i>					
Total	324,713	335,453	465,264	399,913	344,905

Robin W. Morgan
Director

April 1, 2006
Date

Form CSREES-REPT (2/00)

**U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Multi-state Extension Activities and Integrated Activities**

Institution: University of Delaware
State: Delaware

Check one: **Multi-state Extension Activities**
 Integrated Activities (Hatch Act Funds)
 Integrated Activities (Smith-Lever Act Funds)

Title of Planned Program/Activity	Actual Expenditures				
	FY 2001	FY 2002	FY2003	FY2004	FY 2005
<i>Goal 1: An agricultural system that is highly competitive in a global environment</i>	141,684	215,065	218,520	250,479	145,934
<i>Goal 2: A safe and secure food and fiber system</i>	10,321	15,665	83,548	70,002	10,630
<i>Goal 3: A healthy, well-nourished population</i>					
<i>Goal 4: An agricultural system that protects natural resources and the environment</i>	80,002	121,434	68,020	79,168	82,402
<i>Goal 5: Enhanced economic opportunity and quality of life for Americans</i>	72,417	109,924	150,074	146,913	74,589
Total	304,424	462,088	520,162	546,562	313,555

Robin W. Morgan **April 1, 2006**
Director **Date**

Form CSREES-REPT (2/00)

