2000 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

March 1, 2001

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.

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1 PLANNED PROGRAMS

NATIONAL GOAL 1. AN AGRICULTURAL SYSTEM THAT IS HIGHLY COMPETITIVE IN THE GLOBAL ECONOMY

One of the premier programs in the Delaware Plan of Work is focused on Culinary Herbs and Essential Oils at Delaware State University. DSU sponsored the activities of Delaware Herb Growers & Marketers, who (1) held their four annual meetings at D.S.U., (2) published a new Member Directory for public distribution, (3) co-sponsored the symposium "Plants and Peoples" on the dedication of the Claude E. Phillips Herbarium at D.S.U. on May 13, and (4) held their annual Herb Festival at the Delaware Agricultural Museum and Village on May 20. The Principal investigator was elected to Honorary President of HSA (The Herb Society of America) and continues on the Board of Directors as Program Chair of IHA (International Herb Association) and the editorial boards of Herbs for Health, Economic Botany, and Journal of Essential Oil Research, as well as an advisor for ABC (American Botanical Council) and consultant for AHPA (American Herbal Products Association). No national statistics of the value of herbs and herb products have been released yet.

The economic damage caused by infecting organisms on animal health for Delaware's billion-dollar poultry industry has devastating potential. 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 addition, UD Poultry Diagnostic Laboratory yearly examines 700 disease cases and tests 20,000 blood samples for antibodies in order to monitor for diseases and to assess the effectiveness of vaccination programs.

Animal production efficiency for dairy farmers points to fly management as key, since these insects can contribute up to a 25 percent loss in milk production. Multiple IPM strategies were instituted when fly-breeding areas were identified in dairy operations by UD scientists, thus reducing fly populations by 60 percent and insecticide use by 30 percent.

At Delaware State University, research results indicate that more than 560 kg K^2O per hectare is required to sustain alfalfa production. Early results indicate that a 1:4 ratio of phosphorus to potassium is adequate to maintain alfalfa productivity, even though lower soil phosphorus levels had been noted when adequate potassium was available to maximize yields and maintain levels of soil phosphorus and potassium.

They have documented that a recently developed Bermuda grass variety will establish from seed. If sprigging can be eliminated, the use of Bermuda grass could increase on the Delmarva Peninsula since a local source of sprigs does not exist. The interseeding of rye into Bermuda grass plots increased total annual forage available for grazing 5.6 Mg
ha^{-1}. Bermuda grass growth during the following summer growing season was not affected.

Agricultural profitability in today's environment means livestock producers must improve forage production and extend the grazing season through irrigation, one aspect of an ongoing UD study on Delaware pasture management.

Soybean variety selection has an impact on the agricultural profitability, so UD researchers conduct cultivar performance trials yearly, and the results are widely disseminated to growers. These trials are an important factor in estimating the potential impact of choosing a cultivar based on its performance.

The management of mushroom flies in commercial mushroom crops has become increasingly difficult, so researchers at UD are investigating a number of alternatives, including pesticides with novel chemistries as well as new modes of action: a growth regulator, nematode parasites, a botanical pesticide, and bacterium producing proteins toxic to fly larvae.

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, caused by a soil-borne fungus, and wheat streak mosaic virus. Knowing that these diseases are present allows UD scientists and Extension to mount educational efforts

and research to prevent these plant diseases from becoming serious problems for Delaware growers. In addition, a major effort was made in lima bean fields to control downy mildew that caused major losses in areas where control measures were implemented too late. Fungicide trials, grower meetings, and newsletters were used to provide control recommendations, and when controls were applied properly, yields were increased by 250 percent.

Current pickling-cucumber harvesting methods fail to remove much dirt and cause excessive product damage, so an innovative farming technique was needed. UD researchers constructed a pickling-cucumber harvester that reduces dirt on the final product by 12 percent, while the innovative redesign of the conveyer decreases product abrasion by 5 percent, saving growers $24 per acre over 5,000 acres in Delaware, thus increasing plant production efficiency.

Many herbaceous perennials, both native to the temperate United States and garden-worthy, are wild-dug (which endangers wild gene pools) due to lack of quick, convenient propagation methods. UD developed micro propagation protocols make quick propagation possible, thus increasing availability. In vitro-generated “plugs” and/or plants of native varieties are now available for ornamental agriculture growers and for the home gardening market.

Seedless watermelons have become the choice of consumers, making the seedless varieties more commercially profitable for melon growers than the seeded ones. UD studies have demonstrated the advantages of commercial seedless watermelon production, which has grown from zero to 1,100 acres—44 percent of the watermelons grown in Delaware are seedless varieties.

Vegetable crop pests can cause an estimated yield loss of 10 to 20 percent because of improper pest sampling, timing of pesticide applications, and selection of inappropriate pest control strategies. New vegetable IPM strategies evaluated and implemented at UD resulted in the use of more than one IPM strategy on 75 percent of the State’s processing vegetable acreage and 94 percent of the State’s fresh market vegetable acreage.

In the UD corn-breeding project, two inbred maize lines were released as plant germplasm. Developed at UD, these lines promise drought tolerance, European corn borer resistance, and desirable agronomic performance.

To reduce the amount of active ingredients applied with herbicides for weed control programs in agronomic crops, UD researchers have focused on two areas: ALS-inhibitor herbicide combinations and the use of genetically engineered herbicide-resistant crops, both of which can lead to reduced resistant weed development and herbicide costs.

Yield losses from pest infestations can range from 10 to 20 percent because of improper sampling and timing of pesticide applications, improper selection of pest

control strategies, and can lead to pesticide resistance. To improve agricultural profitability and agricultural competitiveness, timely information regarding pest outbreaks is disseminated with *Weekly Crop Update* during the production season. *Weekly Crop Update* is a commercial management tool that enhances agricultural profitability and benefits the environment.

More and more poultry growers are using tunnel-ventilated houses to achieve maximum production efficiency during moderate and hot weather. A twenty-five minute instructional video, produced jointly by UD Extension and Auburn University, has been distributed to every major U.S. broiler-producing state and 20 foreign countries. It is estimated that 20,000 people have viewed the tape. The project's economic impact from improved productivity in the poultry industry is estimated at $25 million to date.

Heavily involved in Risk Management Education (RME) for more than three years, UD's Department of Food and Resource Economics (FREC) and Extension have provided national leadership for RME since 1997. UD multi-state activities included department leadership in the completion of 1,250 conferences and workshops attended by 40,000 individuals. UD FREC also organized the national "Extension Risk Management Education Workshop" in St. Louis.

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

Hatch Act Funds	$ 876,568
Smith-Lever Act Funds	$ 370,556
State Matching Funds	$3,566,860
Full-Time Equivalents	37.7

NATIONAL GOAL 2. SAFE AND SECURE FOOD AND FIBER SYSTEM

UD research using high hydrostatic pressure processing for foods is ongoing in the pursuit for methods of food processing that offer food-borne pathogen protection, yet preserves food quality, ensures a greater variety of wholesome foods with intact nutrient content, and retains taste while minimizing changes to the product from the raw or fresh state.

UD Extension food safety training of teachers and volunteers who work with youth in 4-H and other youth development groups, has significantly increased youngsters' knowledge about food safety. Since many youngsters are responsible for preparing food for themselves and their families, their knowledge in handling food safely, and risk associated with microbial contamination of foods has resulted in fewer instances of foodborne illness.

UD Extension has offered the ServSafe certification course for food service managers throughout Delaware. The risk associated with microbial contamination of foods can be reduced if food handlers use the recommended food handling procedures, thus giving

managers of food service facilities the tools for preventing the wide spread of foodborne illness. Ninety-one percent of the 46 individuals taking the Educational Foundation of National Restaurant Association's ServSafe examination passed the test.

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

Hatch Act Funds	$ 3,690
Smith-Lever Act Funds	$26,574
State Matching Funds	$89,402
Full-Time Equivalents	2.8

NATIONAL GOAL 3. A HEALTHY, WELL-NOURISHED POPULATION

Human health depends on nutrition. Individuals with limited funds must get the most nutrition for their food dollars. UD Extension's Lifeskills, a new program conducted in cooperation with the Food Bank of Delaware, Inc. and its member agencies, teaches low-income individuals how to plan and prepare nutritious meals on a limited budget.

Improving diets for low-resource families with young children makes getting the most nutrition for the food dollar a critical concern. UD EFNEP program instructs low-income homemakers with children in how to improve their diets, encourage good lifelong eating habits, and employ smart shopping and budgeting practices so that monthly food allotments last all month.

UD Extension provided to childcare providers and senior residences throughout Delaware included classes that addressed the prevention of osteoporosis through human nutrition and exercise.

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

Hatch Act Funds	---
Smith-Lever Act Funds	$230,545
State Matching Funds	$ 67,085
Full-Time Equivalents	7.7

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

Using state-of-the-art microfocused x-ray absorption and x-ray fluorescence spectroscopies at Lawrence Berkeley and Argonne National Laboratories, the speciation and distribution of zinc and arsenic was determined in contaminated soils and in soils in which various remediation strategies were employed. Additionally, the effect of chemical treatment of poultry litter with alum (aluminum sulfate) on phosphorus mobility was evaluated. With zinc, it was found that discrete zinc mineral phases formed in topsoil samples while the zinc was sorbed to iron and manganese oxides in the subsoil samples. In soils that had been limed to pH 7 or above, zinc precipitated as

a zinc-aluminum hydroxide. The formation of this phase had earlier been found in the laboratory with soil minerals and uncontaminated Delaware soils. However, it had never been identified before in field-contaminated soils. The precipitated phases greatly limit the mobility of zinc, as well as other metals such as cobalt and nickel, and represent an important mode for sequestering toxic metals in soils, greatly reducing their ability to leach into groundwater. Arsenic was found to exist in both the arsenite [As(III)], which is quite toxic, and arsenate [As(V)], which is much less mobile in soils and waters, forms. The two forms were found within small distances of each other in the contaminated soils, indicating the heterogeneity of arsenic species in the soils. As the amount of alum added to poultry litter increased, the speciation of phosphate in the litter materials converted from a soluble form to that of an aluminum phosphate sorbed complex. However, with the alum rates that were investigated, a precipitated aluminum phosphate, which would indicate enhanced stability of the phosphate, had not formed. The use of direct spectroscopic techniques enables one to directly determine what species and phases of contaminants exist in soils. This information provides extremely important information concerning fate, transport, and bioavailability of toxic metal and metalloid contaminants and enables one to make scientifically sound and cost-effective decisions on soil remediation strategies.

Delaware's Nutrient Management Act requires that agricultural waste management practices in poultry-producing areas be developed for soils 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 (P) to be of environmental concern.

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 (P) 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. A long-term impact will be to increase farmer 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.

Nutrient management is an important issue on the sandy soils of the State, especially since the regulation of Total Maximum Daily Load and the realization that many of Delaware’s waterways are environmentally degraded. Because poor nitrogen efficiency increases production costs and decreases profitability, farmers are concerned about nitrogen loss. Based on the acreage involved in the recommendations (about 6,000 acres), the farmers estimate that they have reduced nitrogen applications by 18,000 pounds and increased their net income by $45,000.

UD soil scientists are studying the inactivation and transport mechanisms of viruses in porous media under relevant environmental conditions, which provides an important scientific basis for developing regulations to protect water resources from contamination by microbial pollutants.

UD Extension has developed and will carry out an education/certification program on water quality issues in Delaware, so that livestock producers will know how to comply with the new stricter Nutrient Management regulations. An anticipated long-term impact will be an increase in the knowledge base of affected producers and a corresponding improvement in both the economic efficiency of nutrient management and in water quality conditions in Delaware.

The UD Agroforestry/Tree Planting for Poultry Houses project resulted in a publication and effort on wind break establishment around poultry houses that landowners can implement to reduce soil erosion by wind, reduce snow velocity, maintain energy efficiency for heating in winter months and cooling in summer months, and water and air quality improvements.

Forestry resource management is the main concern of a UD educational outreach effort that connects with forest landowners (rural and urban) to assist them with proper management of forestry crops so they can reap the environmental benefits of proper management.

Wetlands restoration and protection will be enhanced by a current UD project to identify and delineate freshwater wetlands on the Atlantic Coastal Plain, even when wetland hydrology is not present because of the season. Three UD research projects on seasonally saturated wetlands will help to identify indicators of historic hydric soils and wildlife species important to determining wetlands. These projects have the potential to improve our ability to identify and delineate seasonally saturated wetlands.

A DSU project in sustainable agriculture was designed to address the needs of farmers and Extension agents interested in developing an environmentally friendly nutrient use system and growing free-range broilers in a sustainable system. Four methods of poultry manure, fertilizer and manure/fertilizer blends were imposed on corn, soybeans, and winter wheat in a three-year rotation. The only significant difference was commercial fertilizer, which produced significantly more corn. In two separate broiler growth trials using alfalfa, orchard grass and conventional methods of rearing, no significant differences in growth rate, feed consumed and feed efficiency were found between the broilers grown on forages compared to the conventionally reared birds.

To address aquaculture needs in Delaware, DSU has been evaluating the effects of various control measures on filamentous algae in crawfish ponds in Delaware. Three methods of filamentous algae control were compared to ponds where no control was attempted to determine their relative effect on crawfish production in Delaware. Preliminary results indicate that market-size crawfish (22-28 g) can be reached by October regardless of treatment; however, the use of herbicides may be advantageous in improving survival.

UD programs, aimed at ecosystem balance, focus on 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 in other crops, the use of alternative controls including fly tapes, insecticidal baits and biological control.

UD Extension participated in a regional training for leaders in agricultural preservation throughout Delmarva (DE, MD, VA). Workshops provided participants with information on farmland protection and land use issues relating to their communities. Training topics included determining land use, economic, and demographic changes on the Delmarva Peninsula, gauging public attitudes about land use to facilitate community discussion, and analyzing effective land use and farmland protection strategies.

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

Hatch Act Funds	$ 351,655
Smith-Lever Act Funds	$ 202,759
State Matching Funds	$ 1,139,223
Full-Time Equivalents	16.9

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

If children and youth at risk in limited-resource communities are to grow up to become productive citizens, they need to experience and accumulate more resilience factors than risk factors. 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 and enhance resiliency factors for children and youth.

Primeros Pasos, or First Steps, is a licensed bi-lingual early childcare center that provides safe, affordable, and comprehensive childcare to Sussex County's growing Hispanic population. More than a child care facility, *Primeros Pasos* is a concerted outreach effort involving UD Extension that engages parents as partners in the education of their children. The targeted families have two working parents and household incomes that fall below poverty level. Language, cultural, and financial barriers overwhelm many in the community that makes seeking help difficult. Therefore, *Primeros Pasos* is a vital resource for members of the community, with programs that connect Hispanic residents to the social services they may need.

Over the past year in Delaware, safety inspections of child car seats have revealed that 85 percent of seats are either improperly installed or grossly misused by the caregiver.

Through partnerships with government agencies, local hospitals, medical care personnel, police departments, insurance companies, and the Delaware Safe Kids Coalition, UD Extension educators conduct car seat inspections to pinpoint deficiencies, and training for caregivers on the correct way to install and use car seats.

High school students who are behind academically need positive experiences in the work world to prepare themselves to be productive adult citizens. Through the Workforce Preparation Program, overseen by Delaware 4-H, youths are placed in part-time jobs at non-profit organizations during vacation from school. Students also participate in enrichment classes to ensure academic continuity over the summer months. The program provides students with real-work experience on a daily basis, reinforcing the importance of reporting to work as scheduled and the teamwork involved in doing a good job.

One way in which the DSU youth development program and 4-H promoted leadership and decision-making skills with high school students was to prevent after-prom alcohol and drug use by forming the After Prom Promise Committee, which sponsored an event with structured activities to give prom-goers an alternative in a safe drug-free and alcohol-free environment.

Delaware State University and University of Delaware extension educators have participated in the CHILD CARE SATELLITE CONFERENCES. This is an educational training program for childcare providers and is offered eight times a year. The satellite program curriculum is supplied by Pennsylvania State University. Child Care Licensing with the State of Delaware approves satellite workshop credits. As a result of participating in these trainings, providers have reported a greater creativity with program development, improved child-teacher relationships, increased understanding of children's developmental stages, and improved director-teacher relationships.

Because keeping teens in youth programs is difficult, UD 4-H has addressed this problem in part with its Counselor-in-Training Program. Teens remain active in the 4-H camping program by serving as camp counselors, which allow staff to provide quality programs for this difficult-to-reach audience.

Smoking and tobacco use continue to be a huge problem among the youth of Delaware, contributing to the state's high cancer death rate. For the past two years, UD 4-H has piloted a youth tobacco prevention curriculum through a community-based effort that focuses on building life skills and improving resistance skills. Data from the first year of the project shows that the youths who participated report, they will be less likely now to use tobacco products than before participating in the curriculum.

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

Teens need opportunities to hone their leadership skills, so Delaware 4-H provides numerous youth development programs in which teens serve as volunteers, including teaching roles at the club and community level, and in county and state programs. They also plan and conduct programs and training at all levels. The skills learned in 4-H activities carry over into other parts of their lives. For example, most of these teens also serve in leadership roles at church, and school, and half the delegates in the National 4-H Congress from Delaware were either class president or student government president.

UD Extension educators and collaborators have increased their capacity for working effectively with at-risk children, youth, and families. With a State Strengthening grant for implementing community-based programming in three sites throughout the state, these collaborative partnerships have resulted in safe environments for kids to learn, grow, and succeed through after-school and summer camp programs with tutoring, computer experience, communications skills, conflict management, and enrichment activities. Parents benefit from informal opportunities to strengthen leadership skills, reinforce positive parenting practices, and workshops for parent/youth substance abuse prevention.

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

Hatch Act Funds	$ 3,769
Smith-Lever Act Funds	$ 616,359
State Matching Funds	$ 510,660
Full-Time Equivalents	21.0

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: 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.

A series of surveys were developed to evaluate our Plan of Work. Focus groups for each national goal area were held to gather input directly from extension agents, faculty, and staff that conduct programming and research were included in our combined plan of work. To simply and efficiently collect input from stakeholders, it was determined that a simple form survey would be used. To keep the survey from becoming too long, or asking too many questions that respondents would have no experience with which to answer, it was determined that a series of specialized one-page surveys would be the best approach.

Input gathered from focus groups of extension agents, faculty, and staff was used to design the content of the survey forms as well as to identify potential stakeholders and stakeholder groups for each goal area. By subdividing the plan of work in this way, it was possible to "tailor" each survey to the stakeholders and potential stakeholders in a particular goal area. This helped to improve response rate and to reduce non-response errors in the data.

The surveys are all designed in similar fashion. The first question determines an individual's familiarity with/participation in current programming being conducted under the current combined plan of work. The next three questions are designed to specifically address the levels of input included in Volume 65, Issue Number 26 of the Federal Register:

> "Stakeholder input should be sought on a variety of different levels, including but not limited to: advice on priority setting and program development; input on both immediate needs and long term goals; participation in relevancy and portfolio reviews; guidance on monitoring, evaluation, and oversight systems employed to track performance and results; and counsel on emerging technologies and recommendations for public education and discussion about the mission and directions of the institution."

To provide respondents with the opportunity to take a "comprehensive and meaningful role," space is provided for free responses, in addition to the yes/no responses given for each of the following questions: "Do you feel these programs and publications address the right issues?", "Do you feel that programs and newsletters in this area can have a

positive impact on your household?", and "Do you feel there are any issues in this area that we're missing?" These three questions follow the list of current programs, and are specific and direct to facilitate a meaningful response.

The last few questions cover gender, county of residence, and age. This is very basic demographic information that does not compromise the confidentiality of respondents. A question is also included that is specific to the goal area in question. For example, in the survey "Improving Quality of Life in Delaware," respondents are asked how many children under the age of 18 are in their household. In the survey "Supporting Agriculture and Protecting the Environment in Delaware," respondents are asked what their primary source of income is (full-time farming, part-time farming, pension, etc.). The demographic data helps in the evaluation of the surveys' success, and can be compared to known demographics of the state to help ensure that representation is balanced.

The surveys are being presented to stakeholder groups such as commodity groups, farm organizations, and individual companies, as well as mailed out to recipients of newsletters published and distributed by the CANR and its affiliates. To further ensure balanced representation that includes traditionally under-served and under-represented communities, the surveys will also be mailed out to lists of minority farmers and agriculture related businesses in the state. Invitations to participate in the survey will also be included in agriculture related publications and newspapers, to such an extent as is reasonably financially feasible, to offer access to the survey to as great a proportion of the general public as is possible. Both the cover letter and survey use the simplest language possible.

Each individual completing the survey is entitled to review the results of that survey and receive an update as to what specific actions were taken or not taken as a result of the information obtained in the survey. The process is open and fully disclosed in a cover letter distributed with the survey at every presentation. At the bottom of the cover letter sheet is a form that individuals can complete and return to receive results when they are tabulated. The form is deliberately on a separate sheet of paper from the survey in order to protect confidentiality of respondents. At no time can a completed survey form identify an individual respondent.

The stakeholder input survey is designed from the ground up to be fair, transparent, and accountable. Language used is simple, distribution is a thorough and fair as possible, the process is fully disclosed, and free results are made available to any respondent who asks. Reasonable efforts have been made to ensure balanced representation among respondents, with special efforts to include the under-represented and under-served communities. The entire process has been designed to provide meaningful and thorough results, in a simple and manageable form.

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 and F highlight some of the successful programs. All twelve program areas in the Delaware Plan of Work involve some multi and joint activities.

The planned programs were identified through the stakeholder input process as described in sections B. 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 and F 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 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 Section E and F.

E. INTEGRATED EXTENSION AND RESEARCH

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

The economic damage caused by infecting organisms on animal health for Delaware's billion-dollar poultry industry 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, caused by a soil-borne fungus, 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.

Current pickling-cucumber harvesting methods fail to remove much dirt and cause excessive product damage so an innovative farming technique was needed. UD

researchers, working closely with Extension, have constructed a pickling-cucumber harvester that reduces dirt on the final product by 12 percent, while the innovative redesign of the conveyer decreases product abrasion by 5 percent, thus economically benefiting both grower and vegetable processor.

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 (P) 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 over 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.

More and more poultry growers are using tunnel-ventilated houses to achieve maximum production efficiency during moderate and hot weather. A twenty-five minute instructional video, produced jointly by UD Extension and Auburn University, has been distributed to every major U.S. broiler-producing state and 20 foreign countries. It is estimated that 20,000 people have viewed the tape. The project's economic impact from improved productivity in the poultry industry is estimated at $25 million to date.

UD Extension participated in a regional training for leaders in agricultural preservation throughout Delmarva (DE, MD, VA). Workshops provided participants with information on farmland protection and land use issues relating to their communities. Training topics included determining land use, economic, and demographic changes on the Delmarva Peninsula, gauging public attitudes about land use to facilitate community discussion, and analyzing effective land use and farmland protection strategies.

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, ensuring agricultural profitability.

Hessian fly damage has resulted in up to a 20 percent yield loss in wheat fields on the Delmarva Peninsula. Since chemical controls are not effective for this pest, research conducted in DE, MD, and VA has identified potential varieties that can be used to effectively manage Hessian fly in wheat and eliminate the above yield losses. Through Extension trials and IPM strategies, this coordinated effort has demonstrated that the use of Bt sweet corn technology can result in a savings of $16-32 per acre in reduced insecticide costs.

Southeast Pennsylvania IPM group coordinated research and data gathering 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 on compiling comprehensive Pest Management Recommendation Guides for regional field crops and for vegetable crops. The information is specific to local climate, soils, and conditions, comparing the effectiveness of treatments for specific weed, insect, and crop diseases based on data derived from university trials.

The 2000 Mid-Atlantic Crop Management School was a coordinated Extension effort among the universities of Delaware, Maryland, and West Virginia, reaching 188 crop consultants (representing 1,594,950 acres) with information on new pest, nutrient, and crop management practices.

To remain competitive, horticultural professionals need educational programs to learn about and use the most advanced production and marketing information. The best way to learn about new practices is to visit successful nurseries and garden centers. UD Extension and Penn State Cooperative extension each year conducts a professional development tour for Extension and industry professionals.

Extension conducted field trials on farms throughout Delaware and Maryland's Eastern Shore to demonstrate the value of "starter" fertilizer on corn across soils with a wide range of initial soil test phosphorus (P) 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/MD Extension's long-term goal is to increase farmer 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.

UD Extension and Rutgers University share a herd of 300 cows: 200 heifers and 100 milking cows. UD maintains a milking heard 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

The University of Delaware participates in numerous multi-state research projects in support of our State Plan of Work. We will highlight the impact of three of these projects: NE 138, Epidemiology and Control of Emerging Strains of Poultry Respiratory Disease Agents; NE-184, Development of New Potato Clones for Environmental and Economical Sustainability in the Northeast; and NE501, Eradication, Containment and/or Management of Plum Pox (Sharka) Disease.

NE 138 addresses respiratory diseases that have historically caused major economic losses in the poultry industry. Recent restrictions on the poultry industry limiting the use of antibiotics to control these diseases has led to increased pressure on producers to rely more heavily on other methods of disease control, such as the use of vaccines and the emerging technology of antivirals. To support this transition, molecular and conventional research is needed to develop technologies to help identify, diagnose, and control emerging respiratory pathogens.

This multi-state research project has perfected molecular techniques (PCR) for "real-time" (i.e., immediate) identification and quantification for six respiratory disease agents in poultry. They have sorted out the strain relationships for the Infectious Bursal Disease virus, and in the process, identified hitherto unknown reservoirs of infection that are perpetuating epidemics in flocks. The project has also constructed a recombinant DNA vaccine for the fowl poxvirus, giving mild symptoms and protection from other strains of this virus. Finally, through the project's research activities, the poultry industry benefits directly from the monitoring of respiratory pathogen outbreaks. For example, in mid-May 2000, scientists at the University of Delaware used project-developed methods to rapidly screen an egg-layer operation of over 1 million birds, discovering scientific explanations for their egg production decreases approaching 10%. The operator then implemented corrective control measures.

The bottom line impact of this NE-138 includes:

- Diminished production losses from poultry respiratory diseases, and increased profits for the poultry industry.
- Reduced consumer risks through poultry products free of otherwise necessary antibiotics.

Participants in NE-138 represent experiment stations in CT-S, DE, MD, NY-C, AL, GA, IL, NC, OH, and TX, as well as scientist from USDA-ARS, St. Jude Children's Research Hospital, and Department of Virology and Molecular Biology, TN.

The NE-184 project was formed in the mid-1970s to help counter the trend to ever-increasing proportions of potatoes being industrially processed for consumption. The strategy was to develop replacement potato cultivars that were less costly to grow and better suited to processing and regional fresh market niches. One intention was to replace pesticide dependency with naturally resistant selections carrying improved

industrial-processing characteristics. Another major goal was to increase the quality attributes of potatoes grown in the region to enhance their suitability for processing markets and fresh consumption. As a result of this 24-year effort, replacement cultivars have been adopted region-wide by the potato growers, and the processing industry is responding with the construction of several large potato processing plants in the region. As an example, three plants in the state of Maine are presently being expanded, constructed, or planned that will directly provide hundreds of jobs and indirectly add or retain several hundred additional jobs through farm service industries and on-farm employment. These plants alone will provide a market for more that 40,000 acres of agricultural production in the eastern U.S. and cash farm receipts upwards of $88,000,000.

Pesticide dependency has been reduced significantly because of NE-184's cultivar replacement strategies. Reliable numbers on pesticide sales are not available from pesticide companies, but testimonials by East coast potato growers attest to the reduced need to spray crops for diseases and insect pests on the replacement cultivars. Moreover, the substitution of golden nematode resistant potato cultivars in New York is said to have saved the State's industry from what otherwise would have been its complete foreclosure.

One of the greatest successes of the project is the ability to predict on-farm cultivar performance, based on field test results obtained by the project from plots planted from maritime Canada to Florida. These tests have allowed for the selection of very dependable cultivars, no matter the growing conditions. This is a very desirable trait for plant varieties. Statistical models allow scientists to predict a selection's performance, allowing for more efficient breeding schemes. As a result, the NE-184 cultivars are known to perform well in varied soil and climatic conditions, and potato grower participation in the on-farm demonstration of these selections has led to their rapid adoption and the consequent impacts.

A study by the International Potato Center (Lima, Peru) on the economic returns for NE-184 investments has shown an annual rate of return from the NE-184 activities to exceed 40%, for a total net farm value that exceeds $14 million. This rate of return and the resulting pay-off competes favorably with some of the best-annualized rates of return obtained from agricultural research and extension investments.

The bottom line impacts of NE-184 include:

- Increased capacity of potato processing plants in the region, meaning:
    1. Bigger markets for Atlantic seaboard potato farmers, and
    2. More jobs for rural residents.
- Decreased dependency on potato pesticides resulting in:
    3. Reduced costs of potato production in the region, and
    4. Less pesticide exposure for farm workers.

Participants in NE-184 represent experiment stations in DE, ME, NJ, NY-C, PA, FL (Hastings), NC, OH, VA, as well as scientists from USDA/ARS/BARC, PEI, Quebec, New Brunswick, Agriculture and Agri-Food Canada.

In existence for only one year, the plum pox NE-501 group has done a great deal to blunt the impact of a very damaging disease of stone fruits, and the group still holds strong prospects of eliminating the disease from the U.S. Their strategy began early (November, '99) with an inclusive team-building effort uniting LGUs (research and extension), State Depts. of Agriculture, APHIS, ARS, and Industry. By December of 1999, this group had brought together experts from Europe (sources of the virus were earlier identified to be Europe, Chile or Canada), with representatives of all of the above-mentioned organizations to develop an eradication strategy for the Plum Pox virus. They shared all available information, and planned a strategy for future efforts. That meeting had more than 100 attendees. The meeting was filmed, and tapes were made available on VHS and web-based video. By January, PSU and APHIS had both published informative brochures on the subject, and web pages were on line (http://sharka.cas.psu.edu/). In April, a workshop was held that brought together the key regulatory, research, and extension personnel that were being deployed to manage the disease. Agricultural economists met with government regulators and OMB staff and the Pennsylvania Department of Agriculture to begin the development of what was to become the first-ever indemnification plan that included comprehensive reimbursement for current and future losses (It could be a model for future invasive pests).

During the summer, they monitored for spread, perfected sampling and detection techniques, and monitored for presence in indigenous species other than *Prunus*. The education programs conducted in December and April and continuing through the present, enlightened the Canadians to the possibility of plum pox (sharka) and they (the Canadians) found extensive infestations on the Niagara peninsula.

In October, the NE-501 group held a Plum Pox forum attended by about 120 registrants. This group included registrants from 18 states and Canada. These people represented all of the U.S. participants defined earlier, plus at least three Canadian organizations. Since the fall meeting, the group has continued to augment the above-mentioned web page with new publications, film clips, Canadian information, indemnification information, etc. The page averages a little less than 1,000 page views per month since it has been up. An additional on-line tool has been developed for diagnosis of plum pox and other diseases of stone fruits. It is available (pre release) by visiting: http://www.cas.psu.edu/docs/Publications/ppvbooklet/default.htm. Plum pox information has also been incorporated into the tree fruit production guide: http://tfpg.cas.psu.edu/. The continuing education through print media as well as web-based information is a lynchpin in the protection and early recognition of new entries of this virus into the U.S. from Europe, Chile, or Canada. Further, NE-501 is an example for combating other viruses that may enter our perennial crops.

NE-501 is a multi-functional group that is exemplary in its scope, encompassing governmental, industry, and international organizations, as well as both research and extension. It is accomplishing a strong educational role as well. Even though it is destined for replacement at the end of this fiscal year to a multi-state project, and has only been in existence for 14 months, it has had a huge impact, and demonstrates what can be done in a rapid response mode, to bring together multiple organizations to solve a problem.

The Bottom Line Impacts of NE-501 include:

- Meetings and information sharing with international scientists have helped develop a strategy to eradicate PPV in the affected areas. GIS mapping techniques helped track the exact locations of infected trees and gave insight to researches on how the virus spread through the orchard. The combination of these techniques and extensive information sharing proves an optimistic total eradication of PPV in the country.

- Fruit growers all over the country are becoming educated about and trained on identification and control of PPV in orchards and nurseries.

- 850 acres of infected peaches, plums, and nectarines were eradicated. The project has effectively contained the PPV from spreading into other counties and neighboring states, and ensured that the state of Pennsylvania will continue to be one of the nation's leading fruit producers.

- The USDA has created the first indemnification program for reimbursing fruit growers of their losses, current and future, due to PPV eradication program. The project gathered the information that USDA accountants reviewed and presented to the Office of Budget and Management.

- NE-501 set a good example on how a rapid response project could be an effective vehicle in addressing an emergency. This project also serves as a lesson on how to deal with invasive pests in the future.

Participants in NE-501 represent experiment stations in DE, MA, MD, NJ, NYC, NYG, PA, AL, AR, CA, FL, GA, MI, MO, NC, OH, SC, TN, and WA, and scientists from USDA-ARS/Maryland and USDA-ARS/West Virginia.

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: __x_ Multi-state Extension Activities
_____ Integrated Activities (Hatch Act Funds)
_____ Integrated Activities (Smith-Lever Act Funds)

	Actual Expenditures				
Title of Planned Program/Activity	**FY 2000**	**FY 2001**	**FY2002**	**FY2003**	**FY 2004**
Goal 1: An agricultural system that is highly					
Goal 2: A safe and secure food and fiber system					
Goal 3: A healthy, well-nourished population					
Goal 4: Greater harmony between agriculture					
Goal 5: Enhanced economic opportunity	**69,433**	**69,433**	**69,433**	**69,433**	**69,433**
Total					

Form CSREES-REPT (2/00)

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
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Multi-state Extension Activities and Integrated Activities

Institution: University of Delaware
State: Delaware

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

	Actual Expenditures				
Title of Planned Program/Activity	**FY 2000**	**FY 2001**	**FY2002**	**FY2003**	**FY 2004**
Goal 1: An agricultural system that is highly					
Goal 2: A safe and secure food and fiber system					
Goal 3: A healthy, well-nourished population					
Goal 4: Greater harmony between agriculture					
Goal 5: Enhanced economic opportunity					
Total					

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Institution: University of Delaware
State: Delaware

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

	Actual Expenditures				
Title of Planned Program/Activity	**FY 2000**	**FY 2001**	**FY2002**	**FY2003**	**FY 2004**
Goal 1: An agricultural system that is highly					
Goal 2: A safe and secure food and fiber system					
Goal 3: A healthy, well-nourished population					
Goal 4: Greater harmony between agriculture					
Goal 5: Enhanced economic opportunity	**76,913**	**76,913**	**76,913**	**76,913**	**76,913**
Total					

Form CSREES-REPT (2/00)