ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS

for the
Pennsylvania Agricultural Experiment Station
at
The Pennsylvania State University

Federal Fiscal Year 2000

October 1, 1999—September 30, 2000

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Goal 1

An agricultural system that is highly competitive in the global economy.

Through research and education, empower the agricultural system with knowledge that will improve the competitiveness in domestic production, processing, and marketing.

Overview: Expenditures of Hatch and Multistate Hatch funds in Goal 1 related projects amounted to $3,773,826 in 1999 and decreased to $3,616,643 in 2000, a reduction of about 4 percent. This occurred while overall expenditures in Goal 1 increased almost 5 percent from $26,666,790 to $27,902,122 during the same period. Several factors were responsible for these changes. Primary among these, was increased State of Pennsylvania appropriations that targeted agricultural profitability. The large differences reported relative to the original five-year Plan of Work in Goal 1 FTEs reflect increased numbers of SYs that were post-doctoral scholars or research associates, though there were a considerable number of SYs generated by nine-month faculty augmenting up to three months of additional research time from external research grants. Of the 23 faculty hired during FY2000, 11 were hired with a significant part of their proposed research activities targeted to Goal 1 themes. Generally, graduate students are assigned to goals in proportion to the faculty assignments. Therefore, we can expect approximately 60 percent (~250 graduate students) of our graduate students to have significant activities in Goal 1 themes.

Stakeholder listening played a part in the new faculty positions that were filled during the 2000 budget year. Two new faculty will support the large and rapidly expanding green industry; one in turfgrass science and the other in ornamental horticulture. Pennsylvania's corn production finds its way almost entirely into dairy production. Thus, a decision was made to hire a corn geneticist to develop value-added corn based on unique attributes, such as neutraceutical or pharmacological traits, that would support dairy. Dairy represents more than 40 percent of Pennsylvania's farm gate agricultural receipts. Additional positions were added in animal genomics, nutrition, and endocrinology/developmental biology. In response to the large and growing equine industry, we hired an equine veterinary/nutrition scientist. A position for an insect biological control specialist/insect pathologist will address alternatives to pesticides and insect vectored diseases of man and animals. Sustainable agricultural practices will be addressed by a soil management and applied soil physics position.

Achievements related to this goal are as broad ranging as the planned activities described in the 188 projects that support the goal. Some illustrations of the leveraged dollars and accomplishments and impacts can be ascertained by reading our report on the three illustrative planned programs that follow. Generally, interviews of key scientists in the planned programs showed that results and accomplishments were impressive and far-reaching, impacting the intended stakeholders and being adopted more readily than ever before. Early adoption is facilitated by the frequent utilization of electronic and web-based delivery systems and is supported by printed media. Dissemination of information was carried out by faculty with split (research/extension) appointments and also by our county-based educators. A detailed presentation of Goal 1 outputs can be found in the Penn State Cooperative Extension's Annual Report of Accomplishments and Results and is cited here by reference. Further accomplishments and outputs, including publications, can be found in the CRIS reporting system by searching Pennsylvania projects at http://cris.csrees.usda.gov/menu.html.

Many multistate projects have performed at an exceptional level. The Mid-Atlantic Apiculture Research and Extension Consortium (MAAREC) is developing integrated honey bee management techniques for honey quality, bee productivity, and colony sustainability by dealing with devastating mite infestations, bee viruses, and other diseases and insects. This group meets twice a year to develop grant submissions, plan research, and coordinate extension activities. Local meetings are held throughout the five member states to outreach to the bee-keeping community. This is a formal integrated group that meets outside of the traditional multistate format to guarantee better extension involvement. A website (http://maarec.cas.psu.edu) that averages 180 visitors per day presents a newsletter, beekeeping software, and a diagnostic aid for bee parasites, pathogens, etc.

Another superior multistate project is NE-501. This project is working on the invasive plum pox disease affecting stone fruits. This project is an example of how appropriated funds allow us to respond vigorously and effectively, and in a coordinated manner, to address an emerging threat to agriculture. This disease was found in Adams County, Pennsylvania, in September of 1999 after the 5-Year Plan of Work was filed, but has already

received recognition for its website, publications, informational videos, and integration of research, extension, state departments of agriculture, and ARS and APHIS divisions of USDA. Eighteen states and Canada participate in this two-year project. This multistate's website can be visited at http://sharka.cas.psu.edu. The prognosis for preventing the spread of plum pox outside of the two infested counties is guarded, but the multifaceted efforts of this dedicated multistate team documents that almost anything that can be done to eliminate or restrict this disease is underway. This project will be featured in our 2001 annual report, replacing planned program PEN03550 (http://www.agnr.umd.edu/users/nera/Projects/impacts/ne501.html).

Multistate projects that support activities related to this goal are maintained by contributions to nine Northeastern projects (NE-103, NE-132, NE-161, NE-171, NE-179, NE-183, NE-184, NE-185, and NE-501). Individual impact statements are available on the web at http://www.agnr.umd.edu/users/nera/Projects/impacts. Additional information on multistate projects NC-119 and NC-140 can be found in the planned programs for this goal.

Research that keeps the agricultural system highly competitive in a global economy is a traditional area of success for the land grant university system and for The Pennsylvania State University. We are proud that our dairy industry remains competitive and is not in decline, as is common for many other states in the region. We are supporting increased efforts in alternative agriculture, which addresses a large emerging group, as can be seen by the meetings of the Pennsylvania Association for Sustainable Agriculture that attracted more than 1,200 participants to its annual meeting. The forage crops (corn, soybeans, alfalfa, and grasses) that support our dairy enterprise are well researched, and appropriate technologies have been developed and transferred to our end-users to keep them profitable and to sustain farm families and communities. The forests that occupy the largest portion of the state's landmass are being studied for sustainable production systems while minimizing pollution effects, runoff and sedimentation associated with harvesting, and ways to preserve the natural biodiversity. These results are transferred in-state, regionally, and nationally. The Pennsylvania Department of Agriculture funded a project linked to PEN03544 that produced a book entitled, *An International Users Guide to Pennsylvania Agriculture*. This book should greatly assist international visitors in their ability to connect with Pennsylvania's agricultural industries. The outcome should be an enhanced level of global competitiveness for the state's agriculture-based industries.

The public increasingly voices concerns about the effects of pesticide use. Yet insects and diseases left unchecked can literally wipe out a crop. The College's Integrated Pest Management (IPM) programs are uncovering new methods to effectively reduce pesticide use in Pennsylvania while still allowing crops to be grown profitably (http://paimpact.cas.psu.edu/agr9972.html).

Dairy farming is Pennsylvania's largest production agriculture sector, accounting for more than $1.5 billion in output, but it's getting tougher and tougher for dairy farmers to stay in business. To help the state's farmers to succeed, the College develops and teaches new management techniques that boost efficiency and profitability (http://paimpact.cas.psu.edu/agr9987.html). This program area is supported by a dairy managemetn special grant from USDA.

Allocated FTEs to Goal (in units):

SY	PY	TY	CY	TOTAL
155.6	210.9	51.5	85.3	503.3

Total Expenditures directed to Goal ($ in thousands): [1]

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
$2,869	$748	$123	$54	$14,939	$9,170	$27,902

The following agencies/sponsors provided leveraging dollars:

Academy of Applied Sciences
Alltech Inc.
Agway Inc.
American Agricultural Economics Association

American Cancer Society
American Cocoa Research Institute
American Cyanamic Company
American Floral Endowment
American Heart Association
American Society of Hematology
Andrew W. Mellon Foundation
Arthritis Foundation
Associated Landscape Contractors of America
Binational Agricultural Research and Development
California Citrus Research Board
CHR Hansen Biosystems
Church and Dwight Company Inc.
Cornell University
Diamond V Mills
EIEICO Inc.
Environmental Protection Agency
Florachem Corporation
Florida Department of Agriculture and Consumer Services
Penn State Geisinger Health System Foundation
Golf Course Superintendents Association of America Foundation
Horticultural Research Institute
International Atomic Energy Agency
International Regenerative Medical Inc.
Johnson and Johnson
Laminations Inc.
Leukemia Research Foundation
Liferight Foods LLC
McKnight Foundation
Monsanto Company
Mushroom Industry
National Aeronautics and Space Administration
National Institutes of Health
National Science Foundation
National Turfgrass Evaluation Program
North Carolina State University
Ohio Floriculture Foundation
Penn State Research Foundation
Pennsylvania Department of Community and Economic Development
Pennsylvania Broiler Research Program
Pennsylvania Department of Agriculture
Pennsylvania Fish and Boat Commission
Pennsylvania Soybean Promotion Board
Pennsylvania Transportation Institute
Public Health Service
Purdue University
R. W. Johnson Pharmaceutical Research Institute
Rhone - Poulenc Agriculture Company
Roche Animal Health
Roche Vitamins Inc.
Rutgers University
Smith-Kline Beecham Corporation
State Horticultural Association of Pennsylvania
State of California
Texas A & M University
United State Department of Agriculture
United States Department of Defense
United States Department of Interior
United States Golf Association
University of Delaware
University of Maryland
University of Minnesota
University of Vermont
Virginia Polytech Institute
Washington State University
Westway Trading Corporation
Wilkes University

Planned Program: Rootstock and Interstem Effects on Pome- and Stone-Fruit Trees (PEN03626)

Key Themes: Plant Germplasm, Plant Production Efficiency, and Agricultural Competitiveness

Brief Description: Some types of projects can only yield results through coordinated efforts sustained over long periods of time. Research conducted under this Pennsylvania research project is part of a national rootstock research program. Unlike many previous trials of plant germplasm, this study is comparing rootstock material from a single initial source planted in the same year at a variety of geographic locations. This comparison will yield substantially more information than less coordinated trials. Under the auspices of this project, 22 separate experiments, involving apple, tart and sweet cherry, and peach, have been in progress over a ten-year period. Many of these experiments were designed with input from fruit growers, industry consultants, and extension agents. One major focus in these experiments is an analysis of fire blight resistance, which has become a serious problem. Annual assessments are made of tree growth and, as they mature, performance. This information is communicated to the coordinators of the NC-140 Multistate Project to be evaluated along with data from the other cooperators.

Impact/Accomplishment Statement: Information about rootstock performance is communicated to the public in a variety of ways. The publishing of the Pennsylvania Tree Fruit Production Guide on the World Wide Web (http://tfpg.cas.psu.edu) has led to an explosion of potential information transfer. During 2000, this site had 307,682 page views; 102,927 visitor sessions; 35,036 unique visitors; 28,039 home page hits; and 7,020 visitors

that visited the site more than once. Information on rootstock trials was featured at regional extension meetings for fruit growers.

Development and field testing of new rootstocks for tree fruit is leading to more efficient fruit production with the release of pathogen resistant material and rootstocks that lead to smaller trees. The latter can be more efficiently pruned, sprayed, and harvested, which will help Pennsylvania growers maintain their competitiveness in the national and international markets. Pennsylvania tree fruits had a farm gate value of $84 million in 1999; thus, development of improved fruit varieties has a significant impact on producers and consumers alike.

Sources of Funding: Hatch Act, Multistate Hatch Act, and State appropriated funds. This planned program also leveraged the appropriated funds by receiving gifts from the State Horticultural Association of Pennsylvania.

Scope of Impact: Multistate Research and Extension - IL, IN, IA, KS, MI, MN, MO, OH, SD, WI, AR, CA, CO, GA, KY, MA, MD, ME, NC, NJ, NY OR, SC, TN, UT, VA, VT, WA, and WV.

Project PEN03731 will be featured in our 2001 annual report, replacing project PEN03626.

Planned Program: Management Systems for Improved Decision Making and Profitability of Dairy Herds (PEN03625)

Key Themes: Animal Production Efficiency, Agricultural Profitability, and Agricultural Competitiveness

Brief Description: This Pennsylvania research project has the objectives of altering nutrient and management inputs by dairy farmers to positively affect the efficiency of heifer raising programs. An experimental approach was used to evaluate the influence of protein and energy in dairy rations on the efficiency with which dairy heifers use the feed and subsequently grow. A variety of feed mixtures were compared to current standard mixtures. A second approach involved modeling to analyze the impact of various herd replacement variables on the cost of rearing replacement cattle. A herd dynamics model was developed using Pennsylvania and U.S. data for average age at first calving, calving interval, herd culling rate, and calf mortality. By examining the effect of different parameters, the model was able to predict which aspects of the operation would be most critical in increasing profitability.

Impact/Accomplishment Statement: Feed is the major input for dairy farmers, and any improvements in efficiency of feed use would make milk production more efficient and profitable. By evaluating the impact of altered protein levels in feed, farmers may be able to modify their feeding regimes to bring dairy heifers to proper body weight at first calving. The release of this material via the World Wide Web (http://www3.das.psu.edu/dcn), with 2,000 – 2,500 hits per month, has greatly expanded the availability of the research information to the dairy farmer.

Using a simulation model to examine key features of dairy herd replacement allows farmers to focus their attention on the points in the process that are likely to have the maximum economic impact, increasing profitability, and competitiveness. The model showed clearly that farmers need to focus less on aspects of calf mortality and calving interval and more on reducing the culling, or turnover, rate in the herd. Results from these projects have been communicated at extension meetings (average of 13 per year in Pennsylvania, four per year in other states, and three per year internationally, including an annual meeting in Costa Rica designed to provide outreach to all Central American countries). Accomplishments from this Pennsylvania project contribute to the NC-119 multistate project.

Sources of Funding: Hatch Act, Multistate Hatch Act, and State appropriated funds. This planned program also leveraged the appropriated funds by receiving gifts from Agway Inc., Alltech Inc., CHR Hansen

Biosystems, Church and Dwight Company Inc., Diamond V Mills, Florachem Corporation, Lifreright Foods LLC, Roche Animal Health, Roche Vitamins Inc., and Westway Trading Corporation.

Scope of Impact: Multistate Research and Extension - IL, IN, IA, KS, MI, MN, MO, NE, OH, SD, WI, AL, AZ, CA, FL, GA, LA, NH, NM, NY, TN, TX, VA, and WA; and International Research and Extension

Project PEN03824 will be featured in our 2001 annual report, replacing project PEN03625.

Planned Programs: Development of a Genetic Transformation System for Theobroma cacao L. (Cacao) (PEN03550)

Key Themes: Biotechnology, Plant Germplasm, Tropical Agriculture, and Plant Production Efficiency

Brief Description: This Pennsylvania research project has focused on the improvement of cacao through the development of new propagation systems, which would help to advance breeding programs and provide clonal material for farmers. At present, breeding methods are the rate-limiting step in cacao improvement. The first objective of this project was to develop a somatic embryogenesis technique for cloning cacao plants; plants developed through methods developed in this project are now in field tests in St. Lucia. A second objective was to develop a genetic transformation system for cacao, which would also facilitate the production of disease and insect resistant plants (approximately 40 percent of the world crop is lost annually to disease). Such a transformation system was developed, and experimental plants are being grown in quarantine greenhouses for evaluation now. This crop is grown in tropical countries, and an important objective of this project is technology transfer, particularly of the techniques to clone cacao plants, to developing nations. The goal is to contribute to sustainable, economically viable agriculture and to ensure a high-quality product for the U.S. and Pennsylvania market.

Impact/Accomplishment Statement: The world's first transformation system for cacao has been developed and used to create experimental plants that are being evaluated under strict quarantine conditions. With further refinement and proper safety evaluation, this system will permit the development of disease and insect resistant cacao genotypes, which will lead to more sustainable cocoa production. The significant improvements to the technique for cloning cacao plants broke through a research bottleneck that was preventing rapid testing of new cacao varieties in multiple locations.

The identification of improved cacao varieties (particularly, but not limited to, disease and insect resistance) must be followed by rapid dissemination of plant material to the farmers who will benefit. The cloning technique also addresses this aspect of the process, in that it is possible to generate as many as 4,000 new plants from a single cacao flower. This would make it possible to rapidly multiply a new variety from one plant to enough plants to distribute to farmers.

This tropical crop is of great importance to Pennsylvania, producing 1.2 billion pounds of chocolate per year, worth $5 billion per year in the retail market. In addition, it requires about 1.3 million pounds of milk per day, approximately 12 percent of Pennsylvania milk production. However, this industry is entirely dependent upon a predictable, high quality, low cost supply of cocoa from developing nations. The transfer of the technologies developed in this project are an important component of ensuring this supply by providing farmers in those developing countries with a crop that can be grown in a more sustainable fashion. This technology transfer has been accomplished through a variety of means, including a somatic embryogenesis protocol book, distributed free upon request, and workshops in Brazil and Costa Rica, attended by scientists from seven countries. Nearly every major cocoa research laboratory around the world, including at least two private companies, are now using the cloning techniques developed by researchers in this project.

Sources of Funding: Hatch Act and State appropriated funds. This planned program also leveraged the appropriated funds by receiving gifts from American Cocoa Research Institute to support research and outreach on cacao plant propagation techniques.

Scope of Impact: Multistate Research - FL and MD; and International Research and Outreach

Project PEN03756 will be featured in our 2001 annual report, replacing project PEN03550.

Goal 2
A safe and secure food and fiber system.

To ensure an adequate food and fiber supply and food safety through improved science-based detection, surveillance, prevention, and education.

Overview: Expenditures of Hatch and Multistate Hatch funds in Goal 2 related projects, amounted to $544,000 in 1999 and decreased to $507,000 in 2000, a reduction of about 7 percent. This occurred while overall expenditures in Goal 2 were increasing from $4,248,000 to $5,211,000 (an increase of 23 percent) during the same period. Several factors were responsible for these changes. Primary among these was increased State of Pennsylvania appropriations that targeted food safety issues and the success of our faculty in securing grants and contracts. Generally, state appropriations matched federal appropriations more than five-fold, and federal appropriations were multiplied four-fold in leveraged grants. The increase relative to the original five-year Plan of Work in Goal 2 SYs reflect increased numbers of SYs that were post-doctoral scholars or research associates, though there were a considerable number of SYs generated by nine-month faculty augmenting up to three-months of additional research time from research grants. Of the 23 faculty hired during FY2000, three were hired with at least a part of their proposed research activities targeted to Goal 2 themes. Generally, graduate students are assigned to goals in proportion to the faculty assignments. Therefore, we can expect almost 10 percent (~44 graduate students) of our graduate students to have significant activities in Goal 2 themes.

Pennsylvania has a large food processing industry that communicates effectively through the Pennsylvania Food Industry Alliance (http://pfia.cas.psu.edu). They have been engaged in the selection of a new Department Head of Food Science, and also, a cereal-based foods scientist, a protein chemist, and a flavor chemist to that department. A position in Horticulture was added to study the integrated development of controlled atmosphere storage technologies for fruits and vegetables. Achievements related to this goal cover most themes identified in the federal program.

There are 44 projects that wholly or partially support the goal. Some illustrations of the leveraged dollars and accomplishments and impacts can be ascertained by reading the illustrative planned program that follows. Generally, interviews of key scientists in planned programs showed that results and accomplishments were impressive and far reaching, impacting the intended stakeholders, and being adopted more readily than ever before. Early adoption is facilitated by the frequent utilization of electronic and web-based delivery systems and is supported by printed media. Dissemination of information was carried out by faculty with split (research/extension) appointments and also by our county-based educators. A detailed presentation of Goal 2 outputs can be found in the accompanying report of the Penn State Cooperative Extension's Annual Report of Accomplishments and Results, and is cited here by reference. Further accomplishments and outputs can be found in the CRIS reporting system by searching Pennsylvania projects at http://cris.csrees.usda.gov/menu.html.

Multistate projects that support activities related to this goal are maintained by contributions to four Northeastern projects (NE-103, NE-161, NE-179, and NE-185). Individual impact statements are available on the web at http://www.agnr.umd.edu/users/nera/Projects/impacts.

Research is continuing on three activities related to a safe and secure food system. A cooperative agreement and exchange of scientists has been established between the USDA/ARS laboratory in Wyndmoor, Pennsylvania, to research the elimination of microbial food hazards from fruits and vegetables. These include methods of washing, sorting, and detecting contamination. This effort is supported by our Departments of Food Science and Agricultural and Biological Engineering and Penn State's *E. coli* Reference Center, housed in the Department of Veterinary Science. We also have a multi-departmental research project to improve detection and minimize contamination by microbial pathogens in milk and other dairy products which has resulted in revised procedures for storage and detection of pathogens in these products. Finally, the Pennsylvania Department of Agriculture has funded a program to enhance public education of the relative risks of food irradiation. Similar programs to educate the public on risks associated with genetically altered foods are also underway. A food safety impact publication is available at http://paimpact.cas.psu.edu/agr9978.html.

Allocated FTEs to Goal (in units):

SY	PY	TY	CY	TOTAL
26.8	39.5	2.6	16.4	85.3

Total Expenditures directed to Goal ($ in thousands): [1]

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
$374	$133	0	0	$2,592	$2,113	$5,211

The following agencies/sponsors provided leveraging dollars:

Academy of Applied Sciences
AgInnovations LLC.
American Cancer Society
American Floral Endowment
American Mushroom Institute
Colorado State University
Cyrano Sciences Inc.
Dairy Management Inc.
EPL Technologies
General Mills
Germantown International
Golf Course Superintendents Association of America Foundation
Hazelnut Council
Heinz USA
Mushroom Industry
National Honey Board
National Institutes of Health
National Pork Producers Council
Novartis Seed Inc.
Pascobel Company
Penn State Research Foundation
Pennsylvania Department of Agriculture
Pennsylvania Department of Environmental Protection
Pennsylvania Manufacturer of Chocolate Association
Pennsylvania Soybean Promotion Board
Pioneer Hi-Bred International Inc.
Public Health Service
Smith-Kline Beecham Corporation
Tropicana Products Inc.
United States Department of Agriculture
United States Department of Defense
United States Golf Association
University of California
University of Delaware
Utah State University

Planned Program: Improvement in Quality, Shelf-Life and Safety of Cultivated Mushrooms and Other Fungal Products (PEN03494)

Key Themes: Food Quality, Food Safety, and Food Handling

Brief Description: The focus of this Pennsylvania experiment station project has been on quality and safety of fresh and processed mushrooms. Point of sale appearance is an important determinant of consumer acceptance of the product. In addition, interest in foods as sources of dietary requirements has driven research under this project. Research on the effect of calcium chloride in irrigation water led to an increase in mushroom quality and a reduction of postharvest enzymatic browning; both the fresh and canned products were improved through

this technique. The addition of selenium to irrigation water, mushroom spawn, or compost supplements was explored as a means to enhance the nutritional quality of mushrooms. Selenium addition to compost supplements was determined to be the delivery method of choice, resulting in a product containing enhanced levels of selenium compared to standard propagation methods. This dietary micronutrient, which has been associated with reduction in incidence of a variety of diseases, including several types of cancer, may provide growers with a means of increasing consumer interest in mushrooms. Studies of the cause of staphylococcal food poisonings associated with consumption of canned mushrooms from China demonstrated for the first time an unexpected thermal tolerance of staph toxin. The presence of this toxin resulted from improper handling of the mushrooms prior to the canning process. Another major research focus in this project was a series of studies on the potential antimicrobial activity of 10-oxo-trans-8-decenoic acid (ODA), a naturally occurring component in mushrooms. This and related discoveries could be important preservatives and represent a potential value-added component of mushroom production.

Impact/Accomplishment Statement: Improved point-of-sale appearance can lead to increased consumer acceptance at the retail level. Mushroom browning, which results from a variety of food handling sources, can be reduced by application of 0.3% calcium chloride to irrigation water. This practice has become standard nearly throughout the Pennsylvania mushroom industry and is spreading to other operations throughout the United States and the world.

Mushrooms suffer from a lack of nutritional identity in the mind of the consumer. Research conducted under this project has demonstrated that minor changes in production practices could lead to the ability of mushroom growers to advertise mushrooms as a significant source of dietary selenium, a micronutrient implicated in reduction of many diseases, including certain cancers. Addition of selenium to mushroom compost supplements could permit producers to advertise mushrooms as an excellent source of dietary selenium (20 percent of the recommended daily allowance).

Staphylococcal food poisoning traced to canned mushrooms from China was due to bacterial growth and toxin formation prior to the canning process. The failure of high-temperature canning processes to destroy the toxin was unexpected and led to changed practices (improved worker hygiene, proper food handling, and compliance with good manufacturing practices) in the U.S. mushroom industry for pre-canning handling of mushrooms.

Identification of a natural antimicrobial compound in mushrooms has led to the potential for value-added products that could be obtained from off-grade mushrooms or waste products of mushroom production. This compound may be a useful preservative that could lead to new markets for mushrooms and contribute to overall food safety.

The latest in research outcomes from this project are shared at the annual Mushroom Short Course hosted by the Penn State College of Agricultural Sciences. At this Short Course, an average of 250 participants from ten states and six countries learn the latest in research results.

Sources of Funding: Hatch Act and State appropriated funds. This planned program also leveraged the appropriated funds by receiving a grant from AgInnovations LLC.

Scope of Impact: State Specific

Project PEN03783 will be featured in our 2001 annual report, replacing project PEN03494.

Goal 3
A healthy, well-nourished population.

Through research and education on nutrition and development of more nutritious foods, enable people to make health promoting choices.

Overview: Expenditures of Hatch and Multistate Hatch funds in Goal 3 related projects, amounted to $181,000 in 1999 and increased to $253,000 in 2000, an increase of about 40 percent. Overall expenditures in Goal 3 remained level at $2 million. This area of research is conducted primarily within our Food Science Department; at Penn State, many of the Goal 3 theme areas are actively researched by the College of Health and Human Development without Hatch funding. Within the Agricultural Experiment Station, most of the support comes from State appropriations and leveraged dollars. Of the 23 faculty hired during FY2000, three were hired with at least partial responsibility to Goal 3 themes. Generally, graduate students are assigned to goals in proportion to the faculty assignments. Therefore, we can expect almost five percent (~22 graduate students) of our graduate students to have significant activities in Goal 3 themes.

A total of 30 projects contribute to Goal 3, but most in a peripheral manner, with the majority having only a small percentage of effort impacting Goal 3 themes. Important activities relate to the Key Theme of Human Nutrition through consumer decision-making in food selection and preparation. These factors can greatly affect the nutritional value of meals and are often influenced by misinformation and family traditions. As issues of food irradiation, genetically modified crops and food products, and other issues of food safety increase in the public consciousness, research conducted in the Agricultural Experiment Station can help provide science-based information for better consumer decisions relative to nutrition. A Pennsylvania Department of Agriculture grant received in 2000 will increase understanding of the reasons for acceptance or rejection of irradiated meats and will support an education program in this area.

Dissemination of information was carried out by faculty with split (research/extension) appointments and also by our county-based educators. A detailed presentation of Goal 2 outputs can be found in the accompanying report of the Penn State Cooperative Extension's Annual Report of Accomplishments and Results, and is cited here by reference. Further accomplishments and outputs can be found in the CRIS reporting system by searching Pennsylvania projects at http://cris.csrees.usda.gov/menu.html.

Recent hires of two new faculty are producing value added corn and tomatoes, the latter effort has produced a tomato hybrid, now ready for seed increase, with high lycopene levels, giving the tomato fruit a deep red coloration and enhanced antioxidant levels with potential human health benefits. This line was developed without genetic engineering tools. A recent hire in Horticulture will study post-harvest physiology of fruit, as affected by controlled atmospheres, plant hormones, and other factors, with the goal of maintaining fruit quality and nutritional levels over extended periods.

In the multistate and international area, Penn State's nutrition group has developed a nutrition-based business for Kenya. Using United States Agency for International Development (USAID) funds, they developed two processing plants that use local vegetable production to produce a weaning food for local infant populations. These plants stimulate agricultural production by producing new markets for local produce, empower the females in the community to be involved with the management and processing aspects of the enterprise, and result in healthier children with the food produced. World Bank is evaluating the project to see if it can be expanded to support HIV-infected patients with a high nutrient food source.

Multistate projects that support activities related to this goal are maintained by contributions to four Northeastern projects (NE-103, NE-179, NE-183, and NE-184). Individual impact statements are available on the web at http://www.agnr.umd.edu/users/nera/Projects/impacts.

We have recognized the importance of increasing our involvement with Goal 3 and its associated themes. This is underscored by the research component of our three new hires, who will contribute to our capabilities in this Goal, and by the 40 percent increase in federal appropriated funds expended toward this goal as mentioned previously. Given that 98 percent of the U.S. population does not live and work on farms, yet is directly affected

by food-related health and nutrition issues, this will continue to be a focus addressed as a component of many of our projects.

Allocated FTEs to Goal (in units):

SY	PY	TY	CY	TOTAL
14.6	11.4	0.0	7.1	33.1

Total Expenditures directed to Goal ($ in thousands): [1]

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
$141	$113	0	0	$945	$810	$2,009

The following agencies/sponsors provided leveraging dollars:

Center for Rural Pennsylvania
Colorado State University
Penn State Geisinger Health System Foundation
Mary Imogene Bassett Hospital Research Institute
Mississippi State University
National Institutes of Health
National Science Foundation
Ohio Floriculture Foundation
Pennsylvania Department of Agriculture
Pennsylvania Department of Conservation and Natural Resources
Public Health Service
Rocky Mount Elk Foundation
Southwestern Pennsylvania Heritage Preservation Commission
United States Agency for International Development
United States Department of Agriculture

Planned Program: Identifying Strategies for Increasing Confidence in the U.S. Food System (PEN03610)

Key Themes: Human Nutrition and Human Health

Brief Description: In this Pennsylvania research project, the focus has been to apply and interpret national survey tools designed to track the degree of understanding and levels of concerns that consumers have regarding nutrition and food safety. The initial question was to identify where food safety issues lie – on the farm, in processing, or in the home. Other studies have focused on whether nutrition and food safety concerns are interrelated or independent and the role of gender, age, ethnicity, and education as factors affecting food safety concerns. A major issue in survey interpretation involves the construction of questions and, particularly, avoiding pre-supposition in questions. Work on this issue was conducted under this project. Surveys addressing level of confidence about safety of food sold in supermarkets and restaurants, with the related issue of confidence in farmers, processors, and government inspectors to produce safe foods, were compared with similar data collected in Europe.

Impact/Accomplishment Statement: Many consumers do not follow recommended food preparation and storage practices to assure the safety of their food, with up to 50 percent of homes incorrectly handling leftover food. These data were provided to the USDA Office of Risk Assessment and Cost-Benefit Analysis, which used the data to increase understanding of the extent to which food safety problems may originate during food preparation.

Consumers do not link issues of food safety and nutrition, according to survey results. Approximately 60 percent of Americans are concerned about food safety but not nutrition, and vice versa. This suggests that food and nutrition specialists might consider linking these topics to reach an audience that might not otherwise learn about both topics.

Research projects generally build on previous projects. This project is no exception; national surveys of consumer awareness of and concern about food-related hazards, such as *Salmonella, E. coli, Listeria*, and pesticides, have increased steadily over the past eight years. These surveys connect the present project with its predecessor in the experiment station system. Despite this general increase, approximately 40 percent of Americans know little or nothing about *Salmonella, E. coli*, and pesticides, and over 80 percent know little or nothing about *Listeria*.

Not all demographic groups among consumers are equally concerned about food safety. Surveys conducted during this project have identified women, non-whites, those with less education, and older consumers as specific demographic subsets with higher levels of concern.

Sources of Funding: Hatch Act and State appropriated funds.

Scope of Impact: State Specific

Planned Program: Examining Food Issues in Resource Stressed Families, Households, and Communities (PEN03658)

Key Themes: Human Health and Human Nutrition

Brief Description: A variety of objectives were included in this Pennsylvania research project. Activities focused on methods to improve understanding of healthy food and lifestyle choices for Pennsylvania citizens. Specifically, work on the Food Stamp Nutrition Education Program (NEP) involved hiring an evaluator to work with this program to develop research on the impact of the program on changes in participants' understanding of nutrition and food safety. Research projects on consumer perception of risk associated with applications of genetic engineering in soybeans and extension agent perceptions of genetic engineering were completed and summarized. Telephone surveys were conducted to assess consumer activities to address food security as a result of a food systems project called "Edible Connections." Issues of dietary strategy were addressed with low-income couples where one partner is diabetic. Further work to develop and use a tool called "Your Wellness RoadMap" was targeted at participants at risk for chronic disease, particularly diabetes. Emergency food shelter staff were involved in a project to increase awareness of healthful food choices for emergency food packets. Survey tools in association with The Appalachia Cancer Network were designed and distributed to assess the impact of information disseminated about diet and lifestyle choices.

Impact/Accomplishment Statement: Nutrition knowledge and food selection and preparation skills were addressed through NEP programs. Projects were offered via after-school nutrition education, programs at senior centers, newsletters with nutrition information, and Superpantry and SuperCupboard programs. Over 15,000 households were reached for a series of four or more lessons on nutrition topics. Over 260,000 households received the newsletters for a minimum of eight months, with 68 percent of the clients reporting that they found the newsletter useful in making nutrition and lifestyle decisions. Between one-half and three-quarters of selected participants in either the Superpantry or SuperCupboard program reported at least one instance of improvement in food choice. Approximately 70 percent of the children contacted by NEP programs were able to correctly categorize foods by food group, and half improved their general nutrition knowledge. Half of the participants in these programs increased their consumption of fruits and vegetables over pre-program intake.

A local supermarket learned whether customers desired labeling of genetically modified products and what information to include in an informational brochure. Extension educators were informed of the views of extension agents in a three-state area about genetic engineering and the challenges of conducting a public education campaign.

Families in which one partner is a Type 2 diabetic learned of more effective dietary interventions that can be designed for these types of diabetics than they were previously using.

Over 2,000 lessons using "Your Wellness RoadMap" were distributed. According to post-course questionnaires, participants reported significant increases in their use of nutrition information provided by the lessons, increased physical activity, and increased consumption of fruits, vegetables, and fiber.

Sources of Funding: Hatch Act and State appropriated funds. This planned program also leveraged the appropriated funds by receiving grants from Mississippi State University, United States Agency for International Development, and United States Department of Agriculture.

Scope of Impact: Integrated Research and Extension

Goal 4
An agricultural system which protects natural resources and the environment.

Enhance the quality of the environment through better understanding of and building on agriculture's and forestry's complex links with soil, water, air, and biotic resources.

Overview: Expenditures of Hatch and Multistate Hatch funds in Goal 4 related projects, amounted to $1.003 million in 1999 and increased to $1.076 in 2000, an increase of about 7 percent. This occurred while overall expenditures in Goal 4 decreased from $9.344 million to $9.251 million. This area of research is embedded in the activities of all of our departments, and the expectation of the Agricultural Experiment Station is that all science will be evaluated for environmental impact before new information is extended to the public. Even so, only 87 of our 296 projects indicate environmental components. The reality is that most of the remaining projects have informal activities within Goal 4 themes. State appropriations and grants and contracts leveraged federal dollars almost seven-fold for Goal 4.

Dissemination of information was carried out by faculty with split (research/extension) appointments and also by our county-based educators. A detailed presentation of Goal 2 outputs can be found in the accompanying report of the Penn State Cooperative Extension's Annual Report of Accomplishments and Results, and is cited here by reference. Further accomplishments and outputs can be found in the CRIS reporting system by searching Pennsylvania projects at http://cris.csrees.usda.gov/menu.html.

A key activity area for this goal relates to management of non-point source nutrient flow into streams and rivers. This activity area was summarized and featured in a recent impact article (http://paimpact.cas.psu.edu/agr9975.html). Work is continuing on farm manure management, but also is developing science-based information on municipal biosolid disposal plans. In the latter case, biosolids use is being evaluated at 18 county sites. In 1998, Pennsylvania's Department of Environmental Protection (DEP) was charged with extensively testing about 11,000 water supply wells for pesticide contamination. Using GIS technology, Penn State's Office for Remote Sensing of Earth Resources (ORSER) rated and categorized water systems and identified wells that could be excluded from testing because they were not located in areas where contamination was likely. The process saved the state more than $7 million in unnecessary testing fees. The College of Agricultural Sciences' Land Analysis Laboratory also created a GIS database for DEP that allows resource managers to determine how surface water withdrawals will affect future stream flows. The system is used in all five DEP regions in Pennsylvania and is an integral tool in the agency's permitting process. The Pennsylvania Department of Agriculture (PDA) uses College-developed GIS software to streamline the evaluation process for the state's Farmland Protection Program, allowing counties to rate individual acreage for inclusion in the program in a matter of minutes. The software saves thousands of dollars in employee time and resources (http://paimpact.cas.psu.edu/agr99100.html).

College programs are helping to reduce "nonpoint source pollution" of the state's rivers, streams, lakes and groundwater supplies and protect this invaluable resource (http://paimpact.cas.psu.edu/agr9973.html).

Pennsylvania produces more mushrooms than any other state in the nation. It's a commodity that contributes $255 million to the state's economy. But growing mushrooms can be a smelly business. College researchers are studying mushroom production techniques to find ways to lessen the odoriferous impact for people who live near a facility (http://paimpact.cas.psu.edu/agr9974.html).

A related project is examining the use of biosolids as an agricultural fertilizer in Pennsylvania. Twenty farms are included in this study, and, on each farm, a comparison is being made between a field that has never been treated with biosolids versus a similar (soil type, cropping and management history) field that is receiving either municipal sewage biosolids or residential septage application. Comparisons of soil chemistry, potential contamination with synthetic organic chemicals, and pathogenic organisms are made annually. These data are compared with crop nutrient analysis and crop yield data. Results to date suggest that biosolid treatment leads to crop yield and nutrient content consistent with the control fields, on which conventional fertilizer treatments were used, and there is no evidence early in the study for negative impacts on trace element levels, synthetic organic chemical contamination, or pathogen accumulation.

Multistate projects that support activities related to this goal are maintained by contributions to three Northeastern projects (NE-132, NE-171, and NE-184). Individual impact statements are available on the web at http://www.agnr.umd.edu/users/nera/Projects/impacts.

Protecting the environment and insulating the environment from any negative impacts of agricultural activities is a key goal of the Pennsylvania Agricultural Experiment Station and the College of Agricultural Sciences. We have made this an expectation for all of our programs. We are a key College in the Penn State Environmental Consortium, through which we are developing linkages across the entire university. Our own programs are affecting state and local policies and community planning efforts. As can be seen from the Planned Programs and the impact reports cited previously, we are addressing not only Pennsylvania environmental quality, but also that of the Chesapeake Bay and the surrounding region through multistate projects and that of the world through our international programs. Penn State has positioned itself to be the lead institution in the Northeast in research affecting the environment.

Allocated FTEs to Goal (in units):

SY	PY	TY	CY	TOTAL
45.5	84.1	4.3	30.7	164.6

Total Expenditures directed to Goal ($ in thousands): [1]

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
$912	$164	$288	0	$4,567	$3,320	$9,251

The following agencies/sponsors provided leveraging dollars:

Academy of Natural Sciences of Philadelphia
American Floral Endowment
Commonwealth of Virginia
Cornell University
Environmental Protection Agency
Farm Foundation
Horticulture Research Institute
Indiana University
Binational Agricultural Research and Development
Centre County Government
Laminations Inc.
Mifflin County Mapping Department
Monroe County Planning Commission
Monsanto Company
Mushroom Industry
National 4-H Cooperative Curriculum Service

National Aeronautics and Space Administration
National Audubon Society
National Consortium for Rural Geospatial Innovations
National Pork Producers Council
National Science Foundation
Ohio Floriculture Foundation
Penn State - Office of Physical Plant
Pennsylvania Department of Community and Economic Development
Pennsylvania Broiler Research Program
Pennsylvania Department of Agriculture
Pennsylvania Department of Conservation and Natural Resources
Pennsylvania Department of Environmental Protection
Pennsylvania Fish and Boat Commission
Pennsylvania Game Commission
Pennsylvania Office for Information Technology
Pennsylvania Soybean Promotion Board
Pennsylvania Transportation Institute
Pursell Technologies Inc.
Rocky Mountain Elk Foundation
Rutgers University
Southwestern Pennsylvania Heritage Preservation Conservation
Tinker Foundation Inc.
United States Department of Agriculture
United States Department of Interior
University Corporation for Atmospheric Research
University of Delaware
University of Maryland
University of Vermont
Various Arborists
Wild Resource Conservation Fund
Wilkes University

Planned Program: Evaluating Field, Farm, and Regional Nutrient Balance (PEN03415)

Key Themes: Nutrient Management, Water Quality, and Agricultural Waste Management

Brief Description: This state experiment project used a variety of approaches to study the movement of nutrients through systems at local to regional scales. Nutrient balance is an important consideration for farmers from the perspective of profitability and is also critical in predicting and mitigating effects on a landscape level. From an initial focus on fertilizer selection and its effect on crop production, larger scale studies on material movement (e.g., crops, fertilizer, manure, feed) on individual farms (hog, cattle, and cash crop operations) over several years have led to an understanding of what sorts of local decisions have the greatest impact on nutrient balance. Record-keeping and on-farm scales were used in combination with a nitrate flow model to record data in this study. A model was developed to predict how dairy farmers could enhance water quality through their management decisions, and actual farms were compared with the predictions of the model. Additional studies examined how irrigation from a municipal wastewater treatment facility could be most efficiently used both to extract nutrient value from this fertilizer source and minimize leaching of nitrate to groundwater. Finally, watershed nutrient budgets were examined on different scales (nitrogen for the entire U.S. or for individual states; phosphorous for the Chesapeake Bay drainage, both for a local watershed research area in southeastern Pennsylvania).

Impact/Accomplishment Statement: Nutrient balance on individual farms (specifically, how much of the nutrient input is lost to the environment as pollution) depends heavily on individual management decisions made by farmers. Factors such as herd size, decisions about whether to purchase nitrogen fertilizer, and personal commitment to water quality issues all affected the level to which nutrients entered the environment. Education must focus at these individual farm levels to have an impact on this issue.

Comparison of water quality impacts on actual dairy farms compared with results predicted by a model led participating farmers to make adjustments in their dairy management (both in cow feeding and field management) practices in order to enhance water quality.

A simple input/output model developed to track levels of nitrogen and phosphorous on a farm receiving irrigation from a municipal wastewater treatment facility led to management innovations that improved nutrient utilization and reduced nitrate leaching to groundwater.

Intensive study of nitrogen and phosphorous budgets for Mahantango Creek, in Schuylkill County, Pennsylvania, determined that currently used models of watershed management do not adequately account for nutrient

movement when animal agriculture is a significant feature of the farming system. The models in use frequently assume that the watershed is a closed system in terms of nutrient flow. They must be modified to capture information on how farmers are making decisions about their animal production, such as decisions to bring nutrient inputs into the watershed from elsewhere in the form of purchased feeds. Broader scale studies of the Chesapeake Bay drainage were consistent with this observation that watershed management models must be modified to reflect the impact of agriculture.

This research was communicated to government agencies through in-service training on nutrient management issues to the Pennsylvania Department of Environmental Protection (DEP) and USDA-Farm Service Agency. Research results from this project were incorporated into the Pennsylvania DEP "Manure Management Manual" and contributed to the development of the Pennsylvania Farm*A*Syst program, a voluntary program designed to assist farmers in assessing the condition of their farms from an environmental perspective. The latter program was developed in collaboration with Pennsylvania DEP, the Pennsylvania Department of Agriculture, the Pennsylvania Association of Conservation Districts, and the Pennsylvania offices of the USDA-Natural Resources Conservation Service.

Sources of Funding: Hatch Act and State appropriated funds.

Scope of Impact: State Specific

Planned Program: Assessment and Management of Soil and Land Resources Using Geographic Information System Technology (PEN03601)

Key Themes: Land Use and Water Quality

Brief Description: The availability of digital spatial natural resource databases generated by geographic information system technology has revolutionized land use decision-making. This state experiment station project has been instrumental in producing and disseminating this digital information to a wide variety of clients for a diverse array of purposes. The completion of the Pennsylvania digital soil database is in progress, in collaboration with Penn State's Land Analysis Laboratory, Cooperative Extension Geographic Information Systems (GIS) Program, Environmental Resources Research Institute, and USDA's Natural Resources Conservation Service. The digital data are of limited benefit without access. One component of this project has been to collaborate in dissemination of various digital databases through the Pennsylvania Spatial Data Access Program. Even with access, utilization is compromised by the requirement that users must download data to their in-house computers, which must be equipped with correct software for manipulating the data. Another contribution of this project is the development of WEBGIS technologies that will permit users to access and analyze GIS data using only common web-browser software such as Netscape or Internet Explorer. This increased ease of access will dramatically expand the clientele base for GIS data. In the development phase is a project called AgNet which will permit agricultural producers and support industries to contribute information to a relational database that can be accessed by individuals or companies interested in a variety of agricultural issues, from locating suppliers to new business initiation to marketing potential. A final major area to which this project has contributed is in the development of spatial Decision Support Systems for use in environmental assessment, agriculture, and land use planning.

Impact/Accomplishment Statement: Digital soil databases are used in tax assessment of farmland, farmland protection programs, environmental modeling of hydrologic, nutrient, chemical and sediment transport, and nutrient management planning, among other applications. With funding from the Pennsylvania Office for Information Technology, this project is contributing to the mapping of 41 of Pennsylvania's 67 counties in the next three years.

The Pennsylvania Spatial Data Access Program provides free access to all digital geospatial data produced by Pennsylvania state government agencies (http://www.pasda.psu.edu), along with information on how to properly use these files. Over 200 Gbytes of data are downloaded per month, with over 2.4 million hits per year on the site.

In 2000, the Pennsylvania Department of Agriculture spent nearly $75 million protecting farmland throughout 42 counties. The GIS-based Land Evaluation and Site Assessment system was designed to consider a series of factors, such as development pressure and agricultural productivity, and prioritize farms according to need for protection. This system is in use or being adapted for use in 12 Pennsylvania counties and several private preservation programs. Counties are funded by the Pennsylvania Department of Agriculture to obtain the hardware and software necessary to use this system. Further adoption of this system awaits the completion of the soils mapping described previously.

An E-education website (http://www.gis.psu.edu/outreach) has been established in cooperation with the Penn State College of Earth and Mineral Sciences to enable downloads of the LESA system software and to provide tutorials. This system has also been featured in a brochure entitled "Farmland Protection and GIS," published by the National Consortium for Rural Geospatial Innovations.

A GIS-based system was developed and implemented for the Pennsylvania Department of Agriculture to permit tracking of Plum Pox virus in Pennsylvania (NE-501).

A Decision Support System was developed for assessment of Total Maximum Daily Loading modeling and assessment. It has been adopted for use throughout Pennsylvania by the state Department of Environmental Protection.

A Decision Support System was developed for the Dirt and Gravel Roads Program administered by the Pennsylvania State Conservation Commission and is being used throughout the state in county conservation district offices to map and characterize all unpaved roads in the state.

As a contributor to the Chesapeake-Penn State site for the National Consortium for Rural Geospatial Innovations in America (http://www.ruralgis.org), this project was involved in a satellite education program on geospatial technologies broadcast to 31 Native American Tribal Colleges through a cooperative effort with the Southwest Indian Polytechnic Institute and other consortium sites. Tribal College faculty were provided with training on how to teach geospatial technologies and incorporate them into their curricula.

Sources of Funding: Hatch Act and State appropriated funds. This planned program also leveraged the appropriated funds by receiving grants from the National 4-H Cooperative Curriculum Service, National Aeronautics and Space Administration Space Grant, National Consortium for Rural Geospatial Innovations, Pennsylvania Department of Environmental Protection, Pennsylvania Office for Information Technology, and United States Department of Agriculture.

Scope of Impact: Integrated Research and Extension and Native American Outreach.

Planned Program: Nutrient Management in Crop-Livestock Systems (PEN03629)

Key Themes: Soil Quality, Nutrient Management, and Water Quality

Brief Description: The focus of this state experiment station project on nutrient availability from manure and compost and phosphorus management address themes in soil and water quality. Phosphorus management is a key issue in Pennsylvania and the U.S., as evidenced by the USDA/EPA Unified National Nutrient Management Strategy. Nutrient availability from swine manure was monitored in on-farm experiments, with plant

productivity as an important measure of nutrient contributions. Similar studies were conducted on dairy and poultry manures and composts made from them. General research on phosphorus behavior, loss mechanisms, and management strategies are in progress. A Phosphorus Site Index has been proposed for use in Pennsylvania, and this approach is being compared on farms to a nitrogen-based approach and two other phosphorus-based approaches.

Impact/Accomplishment Statement: The Phosphorus Site Index management plan was the most flexible of all tested nutrient management plans. It was also favored by farmers and professional Nutrient Management Plan writers involved in the project.

Based on results to date, the Pennsylvania Natural Resources Conservation Service has developed a new nutrient management plan for the state, which is currently open for public comment. The Pennsylvania Nutrient Management Advisory Board and State Conservation Commission are developing proposed changes in state nutrient management policy.

A contract to educate local conservation districts and assist with private sector certification to write Nutrient Management Plans is in place.

Sources of Funding: Hatch Act and State appropriated funds. This planned program also leveraged the appropriated funds by receiving grants from Rutgers University and gifts from Pursell Technologies Inc.

Scope of Impact: State Specific

Goal 5
Enhanced economic opportunity and quality of life for Americans.

Empower people and communities, through research-based information and education, to address economic and social changes facing our youth, families, and communities.

Overview: Expenditures of Hatch and Multistate Hatch funds in Goal 5 related projects amounted to $378,000 in 1999 and increased to $427,000 in 2000, an increase of about 13 percent. This occurred while overall expenditures in Goal 5 increased almost 10 percent from $2.9 million to $3.2 million during the same period. This increase was due to two factors, an increase in State appropriations and an increase in competitive grants received. Generally, graduate students are assigned to goals in proportion to the faculty assignments. Therefore, we can expect approximately 9 percent (~39 graduate students) of our graduate students to have significant activities in Goal 5 themes.

Stakeholder listening played a part in the new faculty positions that were filled during the 2000 budget year. Five new faculty will support the themes related to this goal. These faculty include a rural family sociologist, a consumer economist, a 4-H youth development scientist, an extension/ researcher specializing in intergenerational programs and aging, a scientist evaluating the effects of policy on family resiliency, and a scientist evaluating various models for family and community enhancement. Dissemination of accomplishments was carried out by faculty with split (research/extension) appointments and also by our county-based educators. A detailed presentation of Goal 5 outputs can be found in the Penn State Cooperative Extension's Annual Report of Accomplishments and Results and is cited here by reference. Further accomplishments and outputs can be found in the CRIS reporting system by searching Pennsylvania projects at http://cris.csrees.usda.gov/menu.html.

Penn State University supports 48 projects that contribute to Goal 5. Five new faculty were hired to support this area of research through a portion of their research activity, and these increased numbers are reflected in a large increase in SYs (increase from 13.6 FTEs in 1999 to 23.9 in 2000) supporting themes within this goal. An

additional portion of this growth in SYs was generated by grants funding post-doctorals and research associates, and by grant dollars purchasing additional research time by our budgeted faculty.

The Pennsylvania AES is an active participant in multistate project NE-167, which has provided the only national survey results of family businesses studied in households. This survey assessed the contributions of these family businesses to rural community viability. Thus, the dynamics of the rural family, business and community are now better understood. According to Joseph Astrachan, editor of *Family Business Review*, the survey methodology developed by the project provided "one of the biggest methodological breakthroughs since the founding of the family business…. This approach provides a more accurate picture of family businesses in the United States and elicits better data about family issues…."

For the first time, NE-167's accurate information has shown that past practices used for estimating family businesses seriously undercounted home-based work. For example, in the Northeast Region more than a quarter of the home-based work was previously missed. We now know that in the Northeast more than half of all employees work for, and more than half of all business receipts come from, family businesses. Moreover, in the Northeast 60 percent of these businesses are in rural areas. This has significant implications for our state and federal labor policies and programs for workforce preparedness.

Multistate projects that support activities related to this goal are maintained by contributions to two Northeastern projects (NE-167 and NE-185). Individual impact statements are available on the web at http://www.agnr.umd.edu/users/nera/Projects/impacts.

Families meet a wide variety of new challenges as they enter the workforce. Penn State programs enhance the capacity of service agencies to help new workers master the life skills they need to be successful in their jobs and in life (http://paimpact.cas.psu.edu/agr9986. html).

In our fast-paced, high-tech society, young people need adequate opportunities to cultivate the skills that are essential to making positive decisions and living healthy, productive lives in an increasingly complex world. Penn State Cooperative Extension 4-H/youth development programs provide these opportunities to thousands of young people throughout Pennsylvania (http://paimpact.cas.psu.edu/agr99119. html).

The world's population is projected to double in the next 50 years, but how will we feed, clothe, and house all of these people? College programs for high school and undergraduate students are educating new generations of scholars and leaders who will help us meet this challenge (http://paimpact.cas.psu.edu/agr9985.html).

Total effort addressing Goal 5 themes is being enhanced over time. The Pennsylvania Agricultural Experiment Station is committed to stabilizing rural families and communities and responding to the needs and perceptions of the urban population. As the opportunities for rewarding work change in response to new technologies, the need for work force training, managerial training for rural industry, etc. expands. Just understanding how much family-based business exists in rural areas (NE-167) took methodological breakthroughs. Penn State is committed to understanding the obstacles facing our citizens and providing information and technologies that will allow them to reach their potential. Our faculty is increasingly recognized for the important role they have already played, and will continute to play, in achieving this goal.

Allocated FTEs to Goal (in units):

SY	PY	TY	CY	TOTAL
23.9	23.1	1.5	10.2	58.7

Total Expenditures directed to Goal ($ in thousands): [1]

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
$333	$94	$104	0	$1,735	$924	$3,190

The following agencies/sponsors provided leveraging dollars:

American Cancer Society
Center for Rural Pennsylvania
Center for Substance Abuse
EIEICO Inc.
Penn State Geisinger Health System Foundation
National Institutes of Health
Pennsylvania Department of Community and Economic Development
Penn State Research Foundation
Pennsylvania Broilers Research Program
Pennsylvania Department of Agriculture
Pennsylvania Fish and Boat Commission
Pennsylvania Public Utility Commission
Public Health Service
Smith-Kline Beecham Corporation
United States Department of Agriculture
University of Arizona
Various Sponsors
Virginia Polytech Institute
William T. Grant Foundation

Planned Program: Preventing Alcohol, Tobacco, and Other Drug Use Among High-Risk Youths (PEN03517)

Key Themes: Children, Youth, and Families at Risk

Brief Description: This state experiment station project was designed to develop and evaluate methods to prevent future alcohol, tobacco, and other drug use among high-risk elementary school children. This project to develop and evaluate intervention success in high-risk youth built upon a foundation of research extending back to 1987, and it has been conducted with additional funding from the National Institutes of Health's Center for Substance Abuse Prevention. The nature of this research is such that new components are being designed, tested, and implemented as data from previous programs are being analyzed. Local needs of participating sites in the current activities were identified through community statistics, interviews with school and community agencies, and local focus groups. The programs were implemented at three sites in Pennsylvania, Florida, and Arkansas through a collaborative Boys & Girls Club/school program. The implemented program combined age-appropriate prevention curricula, homework assistance, tutoring, a parent program, and child and family activities. The study evaluated effectiveness for three cohorts of children over two years of the program (second and third grades) and one year of follow-up data collection (fourth grade). Effectiveness was evaluated using teacher assessments of children, academic records, and self-report questionnaires completed by children and parents.

Impact/Accomplishment Statement: Two prevention programs, SMART Leaders and the Family Advocacy Network, have received national awards for prevention excellence from the Center for Substance Abuse Prevention (CSAP). These two programs have been among the seven programs so honored by CSAP from more than 350 high-risk youth grants awarded since 1987. Identification of the investigator's work has led to participation in CSAP's national dissemination of model programs that promote science-based and empirically proven prevention programs.

SMART Leaders and the Family Advocacy Network have become permanent components of Boys & Girls Clubs of America's SMART Moves national prevention program. The programs are being used in Boys & Girls Clubs and schools across the U.S.

Collaborative after-school programs for high-risk elementary school children offered in a community youth organization contributed to children's behaviors that will help protect them from future alcohol, tobacco, and other drug use. Specifically, the intervention helped program children resist negative behaviors in school, respect teachers and other school personnel, solve peer and school problems, and exhibit ethical behavior.

Sources of Funding: Hatch Act and State appropriated funds. This planned program also leveraged the appropriated funds by receiving a grant from the Center for Substance Abuse Prevention.

Scope of Impact: Multistate Research - AR and FL.

Planned Program: Impacts of Population and Land-Use Change on Local Government Finance in Pennsylvania Communities (PEN03589)

Key Themes: Community Development, Impact of Change on Rural Communities, and Jobs/Employment

Brief Description: This state experiment station project developed and implemented a county-level economic tool that helps local leaders and citizens understand and respond to economic change in their community. The tool, called CIM-PSU (short for "Community Impact Model—Penn State"), includes impacts on employment, population, local governments, and school districts. A variety of analyses were completed in FY2000, including the economic impact of the Plum Pox virus in Adams County orchards (collaborated with multistate project NE-501), the potential impact of residential development in one northern Pennsylvania county, the potential impact of a travel plaza, the economic impact of a major coal mine closing in southwest Pennsylvania, and the impact of a proposed power plant in a southwest county. Most of these analyses included several local meetings with stakeholders to ensure that their concerns were considered in the analysis and so they could understand the results. A web-based interactive workbook for communities to predict the impact of residential development was created for use by local officials and interested citizens. A project examining the effectiveness of land use planning in Pennsylvania, involving professional planners and an advisory group of municipal and county planners, was finished. This project used surveys to all townships and boroughs in the state, all county planning departments, and all Pennsylvania members of the American Institute of Certified Planners. The impact of local taxes is often mentioned as one of the major pressures forcing farmers to sell out for development, but few academic studies have calculated the dollar impact on farmers. A final project focused on the impact of real property taxes on Pennsylvania farmer, relying on U.S. Census data, local tax information, and five-year yield and price averages.

Impact/Accomplishment Statement: Analysis of the potential economic impacts of Plum Pox virus on affected growers in Adams County, Pennsylvania, provided figures that led to state and federal compensation programs that amounted to over $20 million. This was the first full compensation package ever developed for a perennial crop and was co-developed with USDA, PA Department of Agriculture, and Office of Management and Budget.

One community Chamber of Commerce teamed with local government officials to use analyses of the economic impact of a coal mine closing to apply for state grants to assuage employment losses.

The on-line fiscal impact workbook was used a total of 361 times by local planners, local government officials, and interested citizens as part of their local land use planning related to residential development.

Project results were used in FY2000 as the basis for 29 local educational meetings across Pennsylvania with 727 direct person contacts. Five in-service training sessions for county extension staff (train the trainer sessions) were conducted.

A four-week-long on-line course designed to help people understand fiscal impact analysis was developed and offered twice.

Sources of Funding: Hatch Act and State appropriated funds.

Scope of Impact: Integrated Research and Extension

Stakeholder Input Process: Our partnership with Pennsylvania Cooperative Extension provides the core of our stakeholder input. Details of the county, regional, and statewide processes for communicating with stakeholders can be found in the Penn State Cooperative Extension FY2000-04 Plan of Work and the Penn State Cooperative Extension Annual Report of Accomplishments and Results FY1999-2000. Nearly one-half of the administrators, faculty, and staff at the University Park campus supported with research funds have split appointments between extension and research, which greatly facilitates our reliance on extension in the stakeholder listening process.

In addition to extension contacts, we participate in an extensive set of meetings with stakeholders who provide feedback regarding research programming. A listing of groups and events was included in the Pennsylvania Agricultural Experiment Station Research Plan of Work FY2000-04. We also interact closely with the Penn State Ag Council (http://agcouncil.cas.psu.edu/), which represents over 90 organizations or groups with interests in agriculture and food issues. Consideration of stakeholder input was incorporated into decisions on filling positions through discussions among faculty, unit leaders, and college administrators. Individual faculty often include stakeholder issues in their research programs as they renew and revise their experiment station projects.

Examples of the role of stakeholder concerns in the research portfolio of the Pennsylvania Agricultural Experiment Station include research in the Department of Agricultural and Biological Engineering on sensors to assess purity of honey, initiated as a result of discussions with the Honey Board. Discussions with the State Horticultural Association of Pennsylvania led to the refilling of a position specializing in postharvest physiology at the Fruit Research and Extension Center in Biglerville. A position in ornamental horticulture was added with direct input from the Pennsylvania Christmas Tree Growers' Association. The comprehensive needs assessment process conducted by the Cooperative Extension system, in partnership with their advisory board, the Pennsylvania Council of Cooperative Extension Associations, identified a number of research needs that were also addressed by position redescriptions and new hires. Examples include positions addressing intergenerational programming and aging, family resiliency, and youth/family development.

The Pennsylvania Agricultural Experiment Station also underwent a Civil Rights Compliance Review in October, 1999, conducted by USDA-CSREES. As a result of this review, we have made good faith efforts to increase our diversity, both in personnel and in programming. We have increased participation in summer research programs for students from underrepresented groups, provided seed grant money from the experiment station for research projects with an impact on under-served clientele, hired Catherine Lyons as Director of the Center for Minority Graduate Opportunities and Faculty Development, and worked to have all academic units in the College of Agricultural Sciences incorporate specific diversity-based amendments into their unit strategic plans.

Program Review Process: There have been no significant changes in the Merit and Peer Review processes during FY2000 as stated in the Research Plan of Work for the Pennsylvania Agricultural Experiment Station for Federal Fiscal Years 2000 to 2004.

Evaluation of the Success of Multi and Joint Activities:
Multistate Activities: The Pennsylvania Agricultural Experiment Station (AES) recognizes the synergy obtained through collaboration with colleagues at other institutions and continues to participate in formal multistate projects (39 active multistate projects in FY2000). Furthermore, researchers at Penn State frequently enter into successful programs in collaboration with other states, particularly to address time sensitive issues of importance to our mission. Some of these multistate programs are the result of external funding leveraged by Hatch funds, while other programs represent cooperation that has developed naturally around shared issues of importance to the states involved.

Integrated Activities: Penn State University, under the guidance of President Graham Spanier, is dedicated to the goal of becoming "the premier university in the nation in the integration of high-quality teaching, research, and service." The Pennsylvania AES has a commitment to working with Penn State Cooperative Extension and other

elements within the College of Agricultural Science and the University to integrate research with extension/outreach and more formal educational opportunities. Nearly all of our faculty at the University Park campus have joint responsibilities with research and extension or resident education. These faculty conduct basic and applied research that provides the raw material for communicating the latest science-based information to our student clientele, whether they be in our classrooms, at their home computers through our World Campus, or involved in our extension/outreach efforts. The practice of split appointments has continued with our new hires in FY2000.

Multidisciplinary Activities: Much of the research conducted by the Pennsylvania AES is multidisciplinary by nature. Many of the problems encountered in areas such as agricultural production, environmental protection, and consumer education require the collaboration of scientists from disparate disciplines. Faculty in the AES have become active partners in University-wide initiatives, including the Life Sciences Consortium, the Environmental Consortium, and the Children, Youth, and Families Consortium. Each of these Consortia has been built around a theme of multidisciplinary interactions.

Guideline Questions: Research conducted by the Pennsylvania AES is closely tied to the needs of stakeholders through collaboration with the Penn State Cooperative Extension System. This linkage drives our integrated activities – extension listening leads to research, which leads back to extension delivery. The relationship between students as stakeholders and research activity in the AES is less defined, but present nonetheless. Course material is constantly updated, especially in more advanced courses, to reflect new scientific knowledge generated through AES-sponsored research. AES faculty are also mentors for research conducted by undergraduate and graduate students. Stakeholder listening, described in a previous section, is an important component of determining the direction of planned programs, both at the level of the experiment station and for individual faculty in their research. Penn State's Agricultural Council, comprised of over 90 organizations with agricultural interests, represents a valuable source of input to inform research directions.

Several of our planned programs have elements designed to reach under-served and under-represented Pennsylvania clientele. However, the AES recognizes that this is an area that deserves to be strengthened. Toward that end, the AES offered a mini-grant program in FY2000 to encourage programs designed to have an impact on under-served and under-represented groups. Four projects were funded and have begun. These projects involve faculty and staff from four units within the College of Agricultural Sciences and linkages to other Penn State units, with substantial effort to achieve a multidisciplinary approach. The projects are multifunctional, spanning research, extension, and resident education.

The diversity of our budgeted (standing) faculty is also improving. At the beginning of the 2000 fiscal year we had 6 percent minorities in the faculty while 8 percent were minority at the end of the fiscal year. The faculty showed increased numbers in black, hispanic, and asian ethnic groups. Additionally, the percentage of female faculty increased from 15 to 17 percent during the 2000 fiscal year. To be more precise, 7 of the 24 new faculty were female and 2 of 24 were targeted minority groups. Total minorities were 6 of 24.

Expected outcomes and impacts are described through the AES project approval system, with reports of actual outcomes and impacts tracked through the CRIS system.

Many of our multi and joint activities were demonstrably successful during FY2000. For example, an integrated research/extension project (NE-501) addressing the outbreak of plum pox virus in Pennsylvania received the Award of Excellence from both the Northeast Extension Directors and the Northeast Experiment Station Directors. This dual honor is a reflection of the continued value of tight linkage between functionality in addressing issues of critical importance to our stakeholders. Impact statements for many of the multistate projects in which the Pennsylvania AES participates can be found on the web (http://www.agnr.umd.edu/users/nera/Projects/impacts/summary.html).

Integrated Research and Extension Activities: Of the 600 administrators, faculty, and staff at University Park who are supported with research funds, 270 have split research and extension appointments. Funds supporting

this research portion of these positions accounts for the appropriated dollars indicated on Form CSREES-REPT (see Appendix A). The dollars indicated on this form are the result of personnel with a research and extension joint appointment, where the research portion is paid on Hatch or Multistate Hatch funds.

[1]The resources indicated in this document are based on FY2000 expenditures and do not include fringe benefits or University overhead.

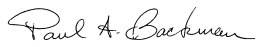
U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Multistate Extension Activities and Integrated Activities
(Attach Brief Summaries)

Institution: PA Agricultural Experiment Station
State: Pennsylvania

Check one:
( ) **Multistate 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	FY 2002	FY 2003FY 2004
Joint Research and Extension Personnel Appointments	$1,511,058			
Total	**$1,511,058**			



Mar 9, 2001

Paul A. Backman, Director