

Annual Report of the University of Vermont Extension and the Vermont Agricultural Experiment Station

FY2000

Introduction

Faculty and staff at University of Vermont Extension and Vermont Agricultural Experiment Station focus on meeting the needs of the state's citizens. Together these experienced and innovative professionals work to seamlessly integrate higher education, research and outreach services to protect and enhance a quality of life that is characterized by a thriving natural environment, a strong sense of community, and a deeply rooted connection to agriculture. As Vermonters begin the 21st Century, they are presented with many opportunities, as well as challenges, that can be effectively addressed through the many resources available at the state's only land grant institution.

University of Vermont Extension's mission is to improve the quality of life for Vermonters by bringing the benefits of research and technology to them. UVM Extension faculty and staff interact directly with many diverse audiences not just in program delivery, but also in learning about and addressing the problems and opportunities affecting Vermonters. More than 100 citizens serve in advisory capacities to ensure that educational programming is targeted and relevant to areas that are important to Vermonters. Working collaboratively with other departments of the University, UVM Extension strives to strengthen efforts to ensure that educational resources remain accessible and relevant to the state's citizens. For many Vermonters, Extension is a critical gateway to higher education serving as the initial or only contact many individuals have with Vermont's land grant institution.

The mission of the University of Vermont Agricultural Experiment Station is to conduct applied agricultural research to benefit the citizens of Vermont. This mission is fulfilled through the following goals: 1) to ensure an adequate supply of food and fiber at a reasonable cost; 2) to enhance general health through improved nutrition; 3) to evaluate and improve environmental practices that may have an impact on the quality of life; 4) to promote the social and economic well-being of people; and 5) to guide the orderly development of communities and land use.

Through teamwork, both faculty and staff contribute to programming success. Extension's four Curriculum/Program Teams, create critical linkages between on-campus and regionally based personnel and infrastructure. These teams include: Agriculture; Nutrition, Food Safety and Health; Natural Resources and Environmental Management; and Family and Community Resources and Economic Development. Each team is co-chaired by one field and one campus faculty member with teaching and/or research responsibilities. These teams are essential to the integration of Experiment Station research, teaching activities, and outreach. Research and teaching faculty collaborators reside in the departments of Animal Sciences, Botany, Community Development and Applied Economics, Nutrition and Food Sciences, Plant and Soil Sciences, and the School of Natural Resources.

FY2000 in Review: Working Together with Vermont Stakeholders

The “Research-Extension-Vermonters” connection is a continuous cycle. The Vermont Agricultural Experiment Station (VT-AES) has the unique responsibility to serve the agricultural and related needs of Vermont through research. UVM Extension provides access to technology, educational programs and practical information concerning Vermont communities, families and homes, farms, businesses, and the natural environment. Put simply, VT-AES researchers study problems identified by people of the state. UVM Extension specialists share the results of the research with Vermonters, helping them to meet their needs--and bringing back to the University the real-life questions and concerns needing further research.

Input and advice from Vermonters.

UVM Extension and the Vermont Agricultural Experiment Station rely on the input and advice from many Vermonters to help determine the relevance, usefulness, and quality of programs. This advice comes from a variety of sources and in a variety of forms. Individuals serve on advisory boards and councils and contribute to the evaluation of existing programs and the planning of new programs. The common thread for all advisors is a commitment to UVM and its high quality research and Extension education. Leaders from throughout the Vermont community regularly and generously offer advice and guidance to UVM Extension and the Vermont Agricultural Experiment Station.

Setting research priorities.

UVM Extension and Vermont Agricultural Experiment Station leaders carefully listen to the wise counsel of citizen advisors and others when determining priorities. In the past year the VT-AES actively sought input on research activities in three ways: 1) the 2000 Vermonter Poll, a telephone poll of a representative sample of Vermonters; 2) focus groups with the VT-AES researchers; and 3) the UVM Extension State Advisory Board. These Vermont stakeholders played an important role in establishing the following research priorities for the VT-AES for 2001 (and beyond):

- **A safe and secure food and fiber system**
 - Assuring safe food throughout the food chain
 - Developing functional and value-added foods
 - Identifying emerging pathogens

- **A healthy, well-nourished population**
 - Promoting healthy eating patterns
 - Assessing the impact of food on human health
 - Promoting food security (access to a healthy diet)

- **An agricultural system that is highly competitive in the global economy**
 - Increasing the efficiency, productivity, profitability, and viability of agricultural systems
 - Enhancing dairy competitiveness
 - Studying the impact of biotechnology and genomic research
 - Assessing consumer attitudes to new technologies in food and agriculture

- **Enhanced economic opportunity and quality of life for Americans**

- Enhancing the competitiveness of rural, agricultural or natural resource-based businesses
- Conducting market analysis for agricultural and food products
- **An agricultural system that protects natural resources and the environment**
 - Developing agricultural practices to enhance and/or protect soil, water or air quality
 - Studying the balance among growth, a working landscape, and protection of the environment

Developing resource-effective Extension programs.

Extension advisors and other Vermonters help guide Extension programs in agriculture, natural resources and environmental management, nutrition, food safety, and health, and family and community resources and economic development. The following are just some examples of programs developed in consultation with a network of UVM Extension faculty and staff and advisors--including clients, commodity groups, and other Extension, Experiment Station, or University colleagues--to help determine the best use of limited resources, the most effective way to deliver a program, and opportunities for creating partnerships.

Working closely with UVM's Proctor Maple Research Center, Extension and VT-AES faculty and staff respond to the needs of Vermont's twelve county sugar maple associations and sugar makers in general. UVM Extension is the only comprehensive educational and informational resource available for both commercial and small, family-based maple sugar operations. Vermont sugar makers have recommended and guided the design of an educational series on small-scale maple sugaring and have contributed critical financial resources to support the work of UVM's Entomology Laboratory.

Results of a survey of local food shelves and community kitchens conducted by the Vermont Food bank has been used by UVM Extension to determine what types of nutrition and food safety workshops should be conducted to help Vermonters with limited resources.

UVM Extension is an important leader among the vast number of individuals and organizations throughout the state working to support the positive development of Vermont youth. More than 1,500 volunteers invest numerous hours and incredible talent to 4-H camps and clubs and other youth-related program efforts. In FY2000 the program Expanding the Caring Community, was guided by more than 300 advisors and partners as it successfully carried out educational and recreational activities for at-risk youths in five Vermont communities.

Each year the Master Gardener program serves as a science-based information resource to home gardeners and others. In just one year, 275 volunteers responded to toll-free hotline calls and e-mail requests. Vermonters are also able to access hundreds of UVM Extension research-based gardening and insect fact sheets on the Web.

Reaching more Vermonters.

At an annual retreat in October 2000, our advisors discussed effective program delivery. They offered valuable advice on ways to use computer and other technology to reach more Vermonters and recommended we be mindful of the number of individuals who do not own or use computers. Therefore, UVM Extension and the VT-AES use several delivery methods--including the Across the Fence television show reaching more than 80,000 viewers each week day, brochures, fact sheets, e-mail distribution lists, farmer discussion groups, Web sites, workshops, meetings, radio and newspaper, and newsletters--to share research and educational programs. Citizen advisors conceived of the UVM Extension and VT-AES newsletter, Impact, now in its seventh year of production. Impact is distributed quarterly to stakeholders.

Increasing collaboration within and beyond UVM.

The 21st century calls for greater collaboration and inclusiveness in program visioning and planning. UVM advisors have emphasized greater collaboration between UVM research and Extension faculty efforts. In FY2000 the Vermont Integrated Research and Extension Competitive Award Program was established to provide funds for such worthy projects. Advisors helped to review proposals and the program funded two three-year projects in FY2000. One project is dedicated to the examination of the cold-hardiness of the western flower thrips, a common greenhouse pest. The second project explores the use of touch-screen computer technology in the delivery of health and nutrition information to senior citizens. A second round of three-year awards will be made in FY2001.

As a part of the Division of Agriculture, Natural Resources and Extension, the VT-AES and UVM Extension hosted, along with the Lake Champlain Sea Grant Program, the 25th anniversary of the UVM George Aiken Lectures in 2000. Aiken Lectures' board members, and other advisors and partners throughout the year helped conceive and design a program dedicated to "Vermont's Watersheds: Sustaining Ecological and Economic Vitality." Through close planning with advisors, local residents, local watershed associations, and state and federal officials, Aiken Lectures 2000 highlighted the cultural, ecological, and economic aspects associated with Vermont watersheds and their implication to quality of life, environmental health and economic vitality. More than 700 people attended the seven sessions held around Vermont. These sessions were timely as Vermont's Agency of Natural Resources has initiated a process to complete watershed plans for the state's 17 major watersheds by the year 2006.

Many UVM faculty and staff are increasing their collaborative efforts with researchers and colleagues from other institutions. The new university Sea Grant Extension specialist is focused on watershed management and stewardship while his colleague at SUNY-Plattsburg offers expertise in fisheries for the bi-state Lake Champlain Sea Grant program. UVM Apple Team researchers and Extension faculty are continuing long-term collaborations with Cornell University to develop and field test new apple cultivars that will eventually improve the hardiness and quality of Vermont's apple crop. UVM Extension agricultural specialists are working closely with the University of New Hampshire to plan, teach and evaluate agricultural business management courses.

An excellent example of UVM researchers working with other states is the bovine mastitis project. VT-AES researchers are active participants in a study of mastitis-resistant animals involving colleagues from 13 states as well as Canada and England. This work has led to scientific breakthroughs that could significantly improve animal health and welfare and potentially save the dairy industry millions of dollars.

UVM Extension is actively collaborating with the New England Vegetable and Berry Extension Consortium to develop and distribute vegetable management guides and small fruit pest management information. UVM Extension food safety specialists are working with faculty from New England, New York, Wisconsin, and West Virginia on food safety programs that emphasize reducing microbial contamination on produce. In cooperation with colleagues throughout New England, UVM research and extension specialists continue to deliver cutting edge research and educational information to aid greenhouse growers in adopting safer integrated pest management strategies.

FY2001 Program Highlights

NGA 1 – To achieve an agricultural production system that is highly competitive in the global economy.

The mission of UVM Extension's Agriculture Curriculum/Program Team is "to enhance profit of agricultural enterprises, strengthen communities, and improve rural and urban quality of life by catalyzing positive change and by encouraging prudent and ecologically sustainable management of capital, resources, and the natural environment." In FY2000, faculty and staff addressed the following programming objectives:

- Teach leadership and management skills and the use of effective tools for comprehensive decision making to enhance profitability.
- Teach production and marketing practices that minimize detrimental impacts and promote the wise use of natural resources upon which agriculture depends.
- Encourage future generations to become engaged in agriculture.

Teaching leadership and management skills.

Agriculture Business Management courses reached nearly 300 students this year with information to help Vermont dairy farmers run their operations more efficiently. This year, the course was taught in two locations--Boscawen, N.H., and St. Johnsbury, Vt. Instruction was accomplished through the collaboration of a wide range of expertise from Extension in Vermont and New Hampshire as well as community business leaders. Success of the course is captured in the following two student evaluations: "This course has given us a greater ability to... make better business decisions... It also made us (my spouse and I) talk about farm finances and goals." "After this course we met with our lender to discuss the expansion and details of what the expansion would require. Every aspect of this course came to light when we met with our lender. It was such a relief to know what our lender was talking about. I think the most rewarding aspect of this course is that I was able to discuss with others in the room how our business operates."

UVM extension has been active in the development and coordination of several **dairy farmer discussion groups**. These groups meet on a regular basis, generally monthly to discuss a variety of topics. The topics chosen by the members include production management, labor issues, financial matters, cow comfort and facilities. Guest speakers from UVM, Extension, out-of-state institutions and commercial enterprises were utilized. Extremely important is the interaction and exchange of ideas and experiences among member participants. As a result of their participation in discussion groups, Vermont farmers: utilized Extension information; adopted recommended management practices; organized and held a large herd annual conference; and functioned as a sounding board for the ideas of university research specialists.

A new endeavor for the agriculture team is the support of a **Vermont Farm Labor Services**. This cooperative effort recently incorporated as a nonprofit organization and has been part of a farm labor steering committee since March of 1999. Bylaws were developed and boards of directors and officers have been appointed. Committees are being formed and are identifying funding resources. As the cooperative grows and strengthens it will take over the management of a temporary labor service for farms.

The **UVM Agronomy Extension Team** continues to use information technologies to enhance extension education programs through web site development, Vermont Interactive Television, and digital camera technology. The Vermont Crops and Soils web site continues to

provide agronomic information over the Internet (<http://pss.uvm.edu.vtcrops/>). It contains extension articles, research summaries, a calendar of upcoming events, and useful links pertaining to field and forage crops, pasture management, pest management, soil fertility and nutrient management. A weekly “Vermont Forage Report” which is part of the web site has provided timely information throughout the growing season. The web site received a national Agronomic Extension Education award last year by the American Society of Agronomy and is used by farmers and agriculture professionals in the state.

While Vermont Interactive Television has been used for many years by UVM Extension, this past winter was the first time that the agronomy team used it extensively for a series of programs called “Forages in 2000”. For four consecutive Tuesdays, a two-hour program (10am to noon) was televised over 10 sites in the state. Each weekly program focused on a specific subject (forage quality, phosphorus management, pest management and new forages). Over the four-week period, we had 251 participants.

Through the Agronomy team’s program on phosphorus management, Vermont farmers were able to “link” in Dr. Larry Satter, a nationally recognized USDA animal nutrition researcher from Wisconsin. Although he never had to leave Madison, he was able to make a presentation, answer questions and discuss feeding programs with farmers from all over Vermont. When asked what information from the day’s program would be directly used on their farm, about 50% of the farmer participants stated that they would evaluate and reduce P in their feed. As a result of the success of this program, the VIT program concept will be expanded to become the Dairy VIT Program. Interactive programs will be televised throughout the winter months covering various current topics in feed management, animal health, agronomy and finances.

An Introduction to **Sheep Management** course was offered this past year with the cooperation of UVM Extension, a veterinarian and a local producer. Twenty-five people enrolled in the class that consisted of six different sessions. These sessions included genetics, nutrition, health, record keeping, marketing and whole farm planning. Participants in the management course have continued to improve and enlarge their farming operations. One participant is now an active producer in Vermont Quality Meats, a cooperative that is selling lamb, along with other meats, to up scale restaurants in New York City and Boston.

During this past year the UVM **horticulture** specialist collaborated with a colleague from the University of Maine, to develop a database of the entire Environmental Horticulture Industry (landscape, nursery, greenhouse and related) of New England Nursery Association Board (underwriters for this project). They developed the results into a brochure that was sent to each state association for distribution. Results were summarized by state, and region. The value of this industry in New England is \$33.7 billion, with Vermont at \$187 million.

UVM Extension faculty and staff actively sought and received input from Vermont apple growers, agricultural industry representatives, and government personnel into all aspects of the integrated **UVM Apple Extension and Research Program**. This input shaped program development and implementation. Based on that input the UVM Apple Program includes: orchard visits and one-on-one interactions to provide ‘site-specific’ information; workshops, meetings, farm tours, The Vermont Apple Newsletter; IPM Alerts; the development of the UVM Apple Orchard Website for apple education and information; the development of the AIM (Apple Information Manager) which is a regional collaboration of apple growers, and extension/research personnel from all six New England states; and applied research based on the priorities and needs as defined by the apple industry in Vermont. The regional applied project (NE-183): “Multidisciplinary Evaluation of New Apple Cultivars” is directly related to grower-defined priorities. This project received the “2000 Northeastern Multi-state Research Award for Excellence.” In addition, the “Vermont Fruit Quality Research and Education Project” funded

with monies received through the Vermont Department of Agriculture via a special state appropriation is a direct result of grower involvement in defining extension and research priorities.

In FY2000, Vermont's vegetable and berry growers were provided with individual consultations through 90 on-farm visits and over 500 phone and e-mail consultations with faculty and staff of the UVM Extension **Vegetable and Berry Program**. Production and pest management advice was supplied in a biweekly newsletter e-mailed to 100 growers and mailed to 3600 members of Vermont's agricultural community as part of the Vermont Department of Agriculture's newsletter, "Agriview." Revisions were made to the "New England Vegetable and Berry Management Guide" and updated editions were distributed to 140 members of the Vermont Vegetable and Berry Growers Association. Soil tests, tissue test recommendations and plant pest diagnoses were provided for hundreds of growers. Educational events organized included: six on-farm workshops, two winter meetings, and the 1999 New England Vegetable and Berry conference, chaired by a UVM Extension faculty member, which was attended by 1,201 people (818 of them farmers, 92 Vermonters). Of the 180 farmers returning evaluations, 98% said the conference would help improve pest management on their farm and 68% said it would help improve farm profitability.

Each year, UVM Extension cooperatively plans and conducts 12 county **maple** schools with maple producers, the Vermont Department of Agriculture, the Vermont Department of Forests and Parks, and the UVM Proctor Maple Research Center. More than 800 maple sugar makers, equipment manufacturers, dealers, and processors attended maple schools in FY2000. Industry leaders have met to brainstorm topics of interest and need for this coming year's exciting program and we are drafting a county maple school agenda that's aimed at their specific interests and needs.

Teaching production and marketing practices.

UVM Extension's **Pesticide Applicator Training Program** had success this past year using interactive television to reach more than 200 people in all areas of the state who wish to become trained to take the Vermont Certified Pesticide Applicator exam. Using this format, the fees for the training can be kept low and the applicators can attend a VIT site near their home. This training follows the PAT Core Training Manual. The responses to this training have been very favorable and we will continue to offer more programs using this format of delivery.

The Vermont **Integrated Pest Management (IPM)** program is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks. The Vermont IPM Program focused on the IPM priorities and needs that were identified through participatory assessment methods that were conducted in Vermont and the region. The four specific areas of concentration are Apple, Maple, Berry and Vegetable, and Greenhouse Ornamentals. In all areas, the program is closely integrated with research. In addition, the program involves diverse participants (i.e., commercial producers, state agency representatives, agricultural industry personnel, researchers, private consultants, etc.) and includes regional collaborative efforts. This year methods of information delivery include one-to-one communication, field validation trials, workshops, training sessions and presentations, dissemination of educational materials through newsletters and the UVM Website.

Many pests threaten the maple syrup industry, which contributes significantly to Vermont's economy. UVM Extension and VT-AES **maple IPM** specialists must keep syrup producers informed of the threat of pests and what they can do about them. The Asian long-horned beetle is currently the greatest threat to maple. UVM entomologists are coordinating a

public awareness program to educate Vermonters about this pest. They have received thousands of calls from concerned citizens. With help from sugarmakers and the public, the entomologists hope to detect any Asian long-horned beetle infestations in Vermont quickly, thus avoiding widespread damage.

Greenhouse ornamentals, which contribute significantly to Vermont's economy, are attacked by a wide array of pests, many of them difficult to manage. Use of **greenhouse IPM** practices by growers will reduce pesticide use, thereby protecting the environment and human health. UVM entomologists coordinated hands-on workshops in Maine, New Hampshire, and Vermont for growers to teach them how to effectively implement IPM in their greenhouses. The workshops will lead to greater adoption of IPM principles among growers, as well as reduced pesticide use. The result will be higher quality ornamentals produced at lower cost.

In FY2000, 200 Vermonters attended the 13-week Vermont Interactive Television course for training Master Gardeners in cooperation with faculty in the Plant and Soils Science Department at UVM. The **Vermont Master Gardener Program** is staffed entirely by trained volunteers who promote successful and environmentally prudent home horticulture practices. This is accomplished through in community activities and education. One successful component of this program is the Master Gardener Help line. Last year, this free service supplied home horticulture information to over 2,800 Vermonters statewide. Consumers used a toll free phone number to reach trained volunteer Master Gardeners at the Help line office in South Burlington. Additional electronic inquiries were answered by e-mail. Volunteers' answers are based on UVM recommendations and Extension publications. Master Gardener volunteers are supported in their research by an extensive resource library and by specialists within UVM, state agencies, and professionals in Vermont's ornamental horticulture industry. In FY2000, the hotline project utilized 1,136 volunteer hours.

The public also submitted plant and insect specimens for identification through the mail or as walk-in clients. Home gardeners and commercial growers in Vermont need a resource for the identification, biology, and management of pests, diseases, and weeds. The **Plant Diagnostic Clinic** provides this information, enabling clientele to make informed decisions on pest management strategies. As a result, the use of pesticides is minimized, thus reducing the impact on human health and the environment.

Engaging future generation in agriculture.

High school guidance departments often downplay or ignore education and career options in agriculture. Thus, young people are not exposed to these options. UVM Extension's **Vermont Farm Youth Corps** (VFYC) encourages career exploration in agriculture by placing young Vermonters with production farms, age-related businesses, and agencies for eight weeks. Employers are mentors and teachers for young people, helping them develop an appreciation for Vermont agriculture and explore agricultural education and careers. In FY2000, 35 young Vermonters participated in VFYC with 12 choosing to continue to work with their hosts (part time and full time) after the VFYC Summer Program ended. All participants will use this knowledge to make education and career choices that include Vermont agriculture.

The UVM Extension **4-H Animal Science Program** is designed to help 4-H Club members and other youth demonstrate increased knowledge and skills in the scientific study of and practical application of work with cows, horses, sheep and other livestock. The program, with a minimum of ten hours, includes agriculture and environmental awareness, genetics and reproduction, record keeping, best management practices, and career opportunities. Teaching teams include volunteers and Extension faculty and program staff. A teenage girl wrote on her annual achievement report: "I hope to continue to be involved in 4-H activities in the future, and

hope to advance in showing skill levels. For this year's project animal I have spent 675 hours. Though this project took a lot of hard work, it was worthwhile and rewarding." A younger teen writes about her experience in a horse club: "In my five years in 4-H, I have learned incredible amounts. I have learned a lot in quiz bowl and through the multiple projects that our 4-H club does. Most of my friends have been made either through 4-H or school. Our 4-H meetings are always fun filled. It is a very busy club."

The **Embryology Program** encourages youth to explore science by having the opportunity to learn about the avian egg, study reproductive system and fertilization, understand embryo development, comprehend the incubation process, incubate and hatch live eggs, and observe live chicks. Volunteers and Extension personnel presented the eight-hour program. This year 2,633 school children from 79 classrooms participated.

Agricultural Research Highlights

In FY2000, Vermont Agricultural Experiment Station (VT-AES) researchers focused some of their agricultural research efforts on the following activities funded with Hatch funds:

Economic analysis of wholesale versus market-diversified apple farms in Vermont.

The apple industry is the leading fruit industry in Vermont and growers are suffering from low profitability. This project examines the current and projected financial situation for both the wholesale and retail orchard. Results indicate that the retail orchard has higher per-acre profitability than the wholesale orchard. The retail orchard faces less financial risk in apple production. However, the wholesale orchard can generate more total income, total assets, and real net worth. A 10% increase in prices has a larger impact on the profitability of both wholesale and retail orchards than a 10% decrease in costs does. This information will help growers to better understand their own financial records, as well as the impact these financial variables have on their profitability.

Hormonal control of growth and energy use by chickens deficient in amino acids.

Dietary deficiencies of amino acids have varying effects on growth, organ size, and endocrine function in chickens. This project examines the effect of amino acid deficiencies on chicken physiology. When dietary tyrosine was held constant, a deficiency of phenylalanine caused an unexpected increase in plasma triiodothyronine. Plasma growth hormone also increased while insulin-like growth factor I decreased. Histology of the thyroid gland revealed small follicles in chicks very deficient in phenylalanine. Heart weights were heavier in deficient chicks but liver weights were unaffected. This information will aid in formulation of optimal diets for chickens, will lead to more economical production of meat and eggs, and may help reduce environmental nitrogen contamination.

Effects of freezing conditions and soil moisture on herbaceous perennial hardiness.

Many perennials grown in Vermont and similar northern climates are lost to cold damage each year. This project examines the effects of various freezing durations, and various conditions prior to freezing, on subsequent survival. Initial results indicate the longer the freezing duration, the greater the injury. Growers will use this information to better control and predict losses of plants in nurseries.

Determine the potential pest problems of new apple cultivars and develop an IPM approach suitable for Vermont conditions. Vermont apple growers have identified cultivar evaluation and effective pest management as priority research areas. A sustainable, integrated approach to managing apple pests in Vermont that combines biological, cultural, physical, and chemical tools in ways that minimizes economic, health, and environmental risks must be developed for any new cultivars. The focus of this research is on whether a disease management

strategy that concurrently integrates apple scab management, fungicide resistance management, and conservation of a biological control agent will be effective in managing powdery mildew, cedar apple rust, and summer fruit diseases. The promising new cultivars in the NE-183 regional apple research project are currently being evaluated.

Characterization of the function of proline-rich cell wall proteins (AtPRPs) in Arabidopsis. The plant cell wall plays a major role in controlling plant growth and in providing plants with a general defense mechanism against bacterial and fungal infection. One of the goals of this research is to characterize the localization of individual proline-rich cell wall proteins in Arabidopsis roots. Results indicate that at least one of these proteins is localized to the growing root hair tip and plays a major role in determining cell wall integrity. These results may allow researchers to select for plants that are better able to deal with environmental stress or pathogen attack.

N-Terminal amino acids analysis as a means of monitoring cyanogen bromide fragmentation of proteins. This study involves the cutting of proteins at the amino acid methionine using cyanogen bromide. Studying the cyanogen bromide reaction by examining the fragments produced may provide information about methionine and proteins containing methionine. The chemical and electrophoretic procedures used to study the peptide fragments haven't given the kind of results expected for standard proteins. The results of this study may be of interest to individuals interested in proteins.

Genetic markers for sap sweetness in sugar maples. Maple syrup production costs are, in part, dependent on fuel costs. Increasing fuel costs reinforce the importance of finding sweeter maple trees. UVM scientists are using a PCR technique to allow the identification of sweeter trees within a few years of planting rather than having to wait until the trees are mature to find those with high sugar levels. Researchers continued to use random primers to correlate PCR patterns with tree sugar level. Inclusion of another ten mature trees with known high or low sugar production will allow a more reliable screen for the sweet trees. High sugar content trees will benefit all maple producers in Vermont.

Manure management on grass hay to improve nutrient use efficiency, yields, and forage quality. Ammonia nitrogen (N) losses from surface-spread manure on grassland can reduce yields or require additional fertilizer N. The purpose of this project is to determine the effect of varying thickness, or dry matter content, of dairy manure on ammonia volatilization and N availability to a grass crop. Results have shown lower ammonia losses and sometimes higher yields from more liquid, lower dry matter content manure. This information will be used to improve recommendations to farmers, thus improving economic returns and avoiding excessive manure applications that could adversely impact water quality.

Regulation of mammary development and lactation. Mammary development is not optimal, thus decreasing lifetime milk yield in dairy cows. The purpose of these studies is to identify the role of transforming growth factor beta in mammary development and lactation. Results indicate that the receptor is expressed during development and lactation. Researchers do not know yet whether these receptors are active during all developmental stages. This information will contribute to scientists' understanding of how mammary growth is regulated.

Regional research project NC-140: Rootstock and interstem effects on pome and stone fruit trees. Testing of new apple rootstocks is essential for North American apple growers competing in a global fruit market. In Vermont, a rootstock planting was established in 1992 to evaluate fireblight-resistant rootstocks for their climatic adaptability. A new planting of 20 rootstocks was established in 1999 to continue this evaluation. The 1992 study found the new semi dwarf rootstock CG30 to be well adapted to the climate and soil of Vermont. CG30 was made commercially available to growers in 1998.

Regional research project NE-183: Multidisciplinary evaluation of new apple cultivars. The apple industry must identify and evaluate promising new cultivars with high fruit quality to remain globally competitive. This multidisciplinary project established plantings in 1995 at more than 35 locations across North America, including one at the UVM Horticulture Research Center in S. Burlington. A new planting of 23 cultivars was established in 1999 to continue the evaluation of new cultivars. Those showing potential include 'Ginger Gold' and 'Honeycrisp.' Based on results of this testing, these cultivars are being planted throughout the state, whereas, other cultivars are being rejected due to their inability to adapt to Vermont's climate.

Develop a relative index of cold hardiness for select new apple cultivars in Vermont. Cultivar selection is a crucial decision for orchardists as it affects an orchard's competitiveness and profitability for many years. The ability of new apple cultivars to withstand fluctuating fall and spring temperatures is an important factor that needs to be considered in cultivar selections. This project analyzed the ability of four cultivars to withstand late spring freezes. A method of hardiness determination was developed. Results indicated that 'Honeycrisp' and 'Pristine' cultivars tolerate late spring freezes better than 'Ginger Gold' or 'Golden Delicious.' 'Honeycrisp' is being planted throughout the state because of its high fruit quality. The results from this study indicate that it is well adapted to survive Vermont's climate.

Chemical, physio-chemical, and micro structural factors that affect the functionality of cream cheese. Cream cheese sometimes develops textural defects and wheying-off during normal storage. This project seeks to identify factors that cause textural defects and wheying-off. Results indicate that texture and syneresis are strongly influenced by storage temperature and cheese pH. Increased syneresis was associated with decreased viscosity of the serum phase. This information may help cheese manufacturers to improve the quality of cream cheese through better control over storage temperature and cheese pH.

Properties of composite edible films made from whey protein concentrates and anhydrous milk fat fractions. The success of whey protein-based edible films depends on novel application concepts and relevant properties. The project examined the results of using the films as tamper-evident packaging, and tested biodegradability, digestibility, solubility, and thermal properties of the films. The films are thermally sealable with good integrity, thus deemed suitable as tamper-evident packaging. The films are showed biodegradable and digestible. The food and pharmaceutical industry, as well as consumers may benefit from using the new biodegradable films in product packaging system to minimize the loss due to tampering.

Improved propagation methods of select, ericaceous woody ornamental plants for use in the Vermont landscape. Rhododendrons and related species (ericaceous plants) can be difficult to propagate. Use of a naturally occurring, ericoid mycorrhizae (beneficial fungus) may improve plant growth. This project develops methods of propagation and production of ericaceous plants suitable for use in the Vermont landscape. Results indicate that a select ericoid mycorrhizal fungus is able to colonize the roots of most species of ericaceous plants tested and improve shoot growth on many of these plants. Thus, growers of ericaceous plants should consider inoculating their crops with ericoid mycorrhizal fungi.

Phenotypic plasticity or genetic specialization in the invasive grass *Phalaris arundinacea*. Invasive species are altering landscapes around the world. The purpose of this research is to determine which genotypes are aggressive invaders. Results indicate that genotypes vary in their competitive ability. Farmers will use this information to decide which genotypes can be planted for forage.

Genetic variation in *Lathyrus maritimus* Bigel: A wild legume with significant agronomic potential. The genetic profile and agricultural potential of beach pea, *Lathyrus maritimus*, is unknown. The objective of this research is to characterize the distribution of

genetic variation of beach pea. This year, UVM scientists have successfully acquired sequence data from two intergenic spacer regions (IGS1 and IGS2) of the chloroplast genome, following extended work to improve sequence data quality. Sequence divergence between the sampled haplotypes is minimal. Initial work on the histone H3D intron (known to be variable within species of legumes) looks promising for providing additional characters to the IGS2 region for sorting out circumboreal relationships. The data provide the basis for choosing wild provenances of this species for agricultural development.

Potential opportunities for producing and marketing high quality milk. The U.S. dairy industry may increase its total revenue and exports by producing high quality milk. This study identifies major factors that affect consumer preference for milk and consumer willingness to pay for high quality milk. Results based on survey data suggest that quality is a very important factor in milk purchase decisions. Many consumers are willing to pay a higher price for high quality milk. Information from this study may help dairy farmers and milk processors evaluate the market potential and marketing strategies for high quality milk products.

NGA 2 – To provide a safe and secure food and fiber system.

and

NGA 3 – To achieve a healthier, more well-nourished population.

Efforts of the UVM Extension Nutrition, Food Safety and Health Team address both the second and third National Goal Areas. It is the mission of this team to “advance the nutritional health of each Vermonter, to encourage Vermonters to adopt nutrition practices that decrease the need for medical intervention; to increase awareness and responsible actions of policy makers and food handlers (“from the farm to table”) to ensure food safety and security.”

UVM Extension continued its collaborations with a variety of groups and organizations to identify programming needs and potential audiences for extension education. Collaborators included: The Vermont Department of Education child Nutrition Program, Vermont Department of Health, Vermont Office of Economic Opportunity, Vermont Department of Employment and Training, Vermont Senior Citizens Meal Sites, Area Agencies and councils on Aging, Vermont Anti-Hunger corps, Nutrition Education and Training (N.E.T.) program, Headstart, Community Action Agencies and Housing Authorities, Adult Basic Education, Northeast Kingdom Mental Health and the Northeast Organic Farmer’s Association.

In FY2000, extension faculty and staff addressed the following programming goals and objectives:

- **Vermonters will adopt nutrition and related lifestyle practices that promote health.**
 - Educate Vermont adults and youth to use the U.S. Dietary Guidelines and the Food Guide Pyramid to choose a healthful diet.
 - Educate Vermonters to adopt dietary practices recommended for specific life cycle stages.
- **Every child and adult will have continuous access to a safe, affordable, adequate and acceptable food supply.**
 - Increase consumer and producer awareness, understanding and information on food accessibility and affordability.
 - Increase consumer and producer awareness, understanding and information regarding food safety and food borne risks and illnesses.

In FY2000, UVM Extension specialists continued to target the limited resource audience, seniors and youth with nutrition programming. Food safety has remained on the forefront with a focus on training and certifying food handlers. The Vermont Food Safety Network working with UVM Extension faculty held its first “Food Safety Seminar”.

Nutritional needs of Vermonters.

UVM Extension specialists continued to use the multi-session *Making It Fit: Piecing Together Your Food Needs* curriculum to deliver nutrition education to low-income adult audiences across the state. During the past year, 11 series of classes (approximately five sessions per series) were held, with 155 persons participating in the class sessions. Of the participants completing surveys, there was a statistically significant increase from the beginning to the end of the program in the confidence people had in their ability to plan healthy, low cost meals.

The second edition of *Food, Fun and Reading*, a nutrition and literacy education program for pre-kindergarten through grade two, was printed in October. During the past year, 15 train-the-trainer sessions have been taught throughout Vermont to Head Start staff, childcare

providers, Vista AmeriCorps volunteers, and early childhood educators. Eleven *Food, Fun, and Reading* sessions were taught at Head Start Childcare Centers in St. Albans, East Fairfield, Old North End in Burlington, Vergennes, Barre, Randolph, Boltonville, Johnson, North Bennington, and Northfield, reaching 200 low-income children between the ages of three and five. Post-evaluation results showed that 89% of the young participants reached could identify a variety of nutritious foods and place them in the correct food group.

Older Vermonters with limited resources often suffer from ill health, which may be made worse by poor nutrition and unsafe food handling practices. UVM Extension's **Words to the Wise** newsletter helps elderly and homebound Meals on Wheels recipients eat well, safely, and affordably. The newsletter was distributed quarterly to 3,700 Vermont recipients of home-delivered meals. A reader survey showed 71% of respondents used information from Words to the Wise to eat healthier, and 63% used it to do a better job of keeping food safe. 66% of respondents used the information to increase their nutrition knowledge, and 65% used it to save money on food. Area Agencies on Aging reported that the newsletter helped clients eat well and stay healthy. Funding was matched by the Food Stamp Nutrition Education grant.

People with limited resources have a higher rate of nutrition problems than the general population. UVM Extension's newsletter **The Corn & Berry** provides practical information on healthy eating, food budgeting, meal planning, and food safety to limited resource families and individuals. Four issues of **The Corn & Berry** were produced and delivered during FY2000 with circulation at 400 households per issue. Newsletter topics included keeping food safe during shopping and storage, becoming a grocery shopping pro, summertime thirst quenchers, the new dietary guidelines, and healthy school lunches.

The **Expand Food and Nutrition Education Program** (EFNEP) uses trained nutrition paraprofessionals to teach limited resource families how to eat healthy on a tight budget. In FY00, EFNEP reached over 300 adult participants. EFNEP also conducted 28 youth groups reaching 628 youth. Adult participants receive education via individual home visits and in small groups.

A new program this year called **Cooking for Life** is collaboration between EFNEP and the Vermont Campaign to End Childhood Hunger. The 6-week series of classes helps families with limited resources learn to cook and eat healthy. In addition to the hands-on nutrition activities, participants prepare and enjoy a healthy meal each week. At the end of class, they receive a bag of groceries containing the ingredients needed to make the meal they just prepared. The hands-on approach empowers participants to purchase and prepare healthy meals for themselves and their families. In FY2000, EFNEP educators taught 12 Cooking for Life classes in the following counties: Franklin, Chittenden, Addison, Rutland, Bennington, Orange, and Washington.

In general, young children are not developing healthy eating habits early in life. By using **Food, Fun, and Reading**, a National Juried Youth Development Curriculum developed by UVM Extension, adults will involve young children in a series of nutrition and literacy activities. This year 200 low-income children participated in a series of workshops and learned how to choose a variety of healthy, nutritious foods from the food groups. In addition, 299 adults were trained to teach the program. The curriculum will encourage children to develop better eating habits at a young age. Funding was partially matched by the Food Stamp Nutrition Education grant.

Food Stamp recipients who have limited resources and lack nutrition knowledge find it challenging to select a healthy diet. The **Making It Fit** project provided in-depth nutrition education and food preparation instruction to adults on tight budgets. Eleven series of classes provided nutrition education to 155 adults across the age spectrum. Participants made positive

changes related to vegetable and fruit intake, shopping behaviors, self-efficacy regarding meal planning, and nutrition knowledge.

People with limited resources may have limited access to new forms of technology. By providing **nutrition education through the use of laptop computers** in the home, this project aims to improve the diets of limited-resource individuals while at the same time increasing their computer skills. In FY2000, 29 limited-resource adults were reached in four Vermont counties. Participants reported increased intake of the recommended number of servings from the grain, vegetable, fruit, and dairy groups. Mean reported intake of protein, iron, calcium, vitamin A, vitamin C, and vitamin B-6 also increased.

A safe food supply.

Looking for A SAFE Harbor, a curriculum developed by UVM Extension, the University of Rhode Island, and the University of Connecticut was used by Extension Specialists to train 23 volunteer food service workers at food shelf and community kitchens in **safe food handling**. Topics included: the micro world, time and temperature concerns, cross contamination and personal hygiene.

This summer, working in collaboration with Northeast Organic Farmers Association, the Vermont Department of Health, Vermont CSA's and Headstart, UVM Extension faculty presented six hands on food preservation clinics reaching 36 Farm to Family Coupon recipients.

Working in collaboration with the Vermont Department of Education Child Nutrition Services, UVM Extension faculty continue to provide multi level **training for school food service personnel**. Since 1998, 125 school food service workers representing 15 school districts across the state have taken part in a ten-hour basic food safety and sanitation course developed and taught by UVM Extension faculty. Another 52 have taken the 16-hour Serv/SAFE course, designed by the National Restaurant Association (NRA) and taught by UVM Extension Faculty. Ninety five percent of those who took the course passed the NRA certification exam. Seventy-five trainers (day care providers, teachers, and youth leaders) took part in two-hour food safety workshops taught by UVM Extension faculty.

As a member of the **Vermont Food Safety Network**, UVM Extension specialists continued to be active in addressing Vermont's immediate and long-term food safety issues. The Network's mission is to promote food safety in Vermont, and invites and challenges manufacturers, consumers, farmers, academicians, industry and government to work collaboratively. The Network is registered with the state of Vermont as a non-profit and has established bylaws and a committee structure. Meeting three times a year, the Network has continued to focus on two of its initial goals--Education and Training, and Communications. To address these areas, the VFSN has created a website, conducted a needs survey and hosted a successful Food Safety Summit in June 2000. Over 50 people attended the summit to hear diverse perspectives on new food technologies, and shared their ideas and concerns on food safety in general. Extension personnel have taken a key leadership role in developing and sustaining this unique network.

One in ten Americans will need food assistance at some time in their lives. To reduce the risk of foodborne illness associated with food handled at food shelves and meal sites, Extension faculty trained 36 managers and workers at eight food shelves and meal sites in three regions of the state to help ensure **SAFE Food For the Hungry**. According to a site observation sheet to assess and address potential food safety practices, four sites found safer equipment, set up a cleaning and sanitation schedule, and provided food safety training sessions for volunteers. Food service workers will apply skills learned, thus reducing the risk of foodborne illness.

Results of a 1998 survey showed that one in five home canners in Vermont put family members at risk for botulism by using unsafe methods to process foods. This project provides research-based information and instruction on food preservation methods for Vermont consumers. Working in collaboration with the Northeast Organic Farming Association and Women, Infants, and Children, Extension faculty conducted **food preservation** clinics reaching 46 consumers and produced two Across the Fence shows, six press releases, and six radio programs. More than 700 people visited the UVM Extension food preservation exhibit at Caledonia and Orleans County fairs. This information will help consumers practice safe home food preservation skills.

Centers for Disease Control estimate that each year foodborne microbes cause 76 million cases of gastrointestinal illnesses with 325,000 of those resulting in hospitalization and 5,000 in death. As part of a multi-state project, **Food, Flies, and Fungus**—a comprehensive food safety curriculum for youths, ages 10 to 13, was developed, based on experiential learning methodology. In FY2000, UVM faculty revised the curriculum using information from pilot projects conducted in 1998 with 4-H leaders and members in Vermont and Connecticut.

Young children are vulnerable to foodborne illness because their immune systems are not fully developed. Harmful pathogens can be transferred from food to hands or from hands to food, other hands, or cooking surfaces. Frequent, proper hand washing is an effective strategy for helping to prevent foodborne illness. To illustrate why, how, and when to wash hands, an UVM Extension specialists developed an exhibit showing **the six-step hand wash process**, targeted to preschoolers, was developed and piloted at Vermont health and safety fairs in northeast and northwest Vermont. As a result, children will wash hands frequently using the six-step process.

Issues continue to emerge in the food safety arena, such as new virulent pathogens and new food technologies. As a member of the **New England Food Safety Team** UVM Extension has been collaborating for eight years to provide comprehensive, consistent food safety information and education safety programming to New England producers, consumers, and food-related businesses using a regional approach. This year a template for a directory that will include food safety-related resources at New England land-grant colleges or universities was developed. New England consumers will be able to access a variety of food safety expertise and information via this collaborative effort of cooperative Extension professionals.

Food Safety and Human Nutrition Research Highlights

In FY2000, Vermont Agricultural Experiment Station (VT-AES) researchers focused their food safety and human nutrition research efforts on the following activities funded with Hatch funds:

Mastitis resistance to enhance dairy food safety. Mastitis, or inflammation of the mammary gland, is the most costly disease to dairy producers. The necessity for a coordinated effort to study resistance of the dairy cow to mastitis resulted in the design and initiation of a multi-state research project that includes 17 research stations and more than 45 research members. A greater understanding of the organisms responsible for causing mastitis, bovine defense systems, and new methods for enhancing host defense mechanisms ultimately will supply an advantage over current techniques and maintain the safest milk supply in the world.

Improved procedures for enumeration of *L. monocytogenes* in ready-to-eat foods. Detection of low level and injured *Listeria* in processed ready-to-eat food products is essential to protect public health and ensure food safety. This project will develop improved enumeration procedures that are rapid, sensitive, inclusive, reproducible, and adaptable for large-scale testing.

Improved enumeration methods will provide the tools to shift from the current zero tolerance regulatory policies to a compliance criteria-based system.

Dietary carnitine supplementation in the prevention of cardiac arrhythmias. Heart disease is the leading cause of death in the United States. Sudden cardiac death, caused by ventricular fibrillation (VF), may result from a metabolic imbalance in the heart. Dietary treatment may prevent this disorder. The aim of this study is to determine if supplementation of the diet with the nutrient carnitine will prevent the development of VF. We examined how carnitine supplementation in rats influenced the synthesis of metabolites that are known to produce VF in the heart. Adding carnitine to the diet altered the amount of some metabolites. We also examined whether carnitine supplemented hearts exhibited less VF than hearts from controls. Our preliminary findings suggest that carnitine supplementation did not alter the rate of VF in rat hearts pretreated with carnitine.

Solubility and distribution of trace elements in milk based infant formula. Solubility and availability of trace elements in infant formulas are lower than those in human milk. This project aims to improve the solubility of trace elements (Zn, Fe, Cu) in infant formulas by substituting inorganic salts with organic ones. Results showed that the solubility of Mg, Zn, Fe in the formula with organic salts are higher compared with control formula. The results indicate that solubility of minerals in infant formulas could be improved by using organic salts. The findings will help the industry to increase the mineral solubility and to improve nutritional value of infant formula that serves as a substitute of human milk.

Predictors of milk consumption in U.S. school-aged children: Evidence from USDA Nationwide Food Consumption Surveys. Milk consumption of U.S. children has declined over the past decade. The aim of this project was to determine predictors of milk consumption in U.S. school-aged children. Child milk consumption (both type and amount) was strongly influenced by maternal milk consumption. The positive association between maternal and child milk consumption should be considered when designing intervention programs aimed at increasing children's milk intake.

Behavioral and body image therapy in weight management using registered dietitians. Twenty-two percent of adolescents are overweight, and many exhibit negative body image. This study compared a behavioral weight loss program to a behavioral weight loss program that incorporated cognitive therapy for body image in 15 to 18-year-old females. There was a small loss of weight, no change in physical activity, and improved eating behaviors, eating attitudes, and body image. Dietitians should consider the incorporation of body image therapy in weight loss programs for adolescents.

The effectiveness of Internet support for the long-term maintenance of weight loss. Maintaining a weight loss is problematic. This project will determine if the Internet can be used as a vehicle to enhance long-term weight maintenance. After a period of weight loss, subjects are randomly assigned to an Internet, in-person, or control group. Currently, approximately 140 subjects have been recruited to participate. Around 100 have completely finished with the study. This project will determine if the Internet is an effective vehicle for facilitating behavior change.

NGA 4 – To achieve greater harmony (balance) between agriculture (production activities) and (stewardship and protection of) the environment.

UVM Extension's Natural Resources and Environmental Management Team's mission is "to sustain and enhance the quality of Vermont's natural resources through citizens understanding the effects of local decisions on local and global ecological and economic systems." In FY 2000 this team focused on the following priorities:

- Sustainable land resources education and management
- Sustainable water resources education and management
- Public policy
- Conflict management

Sustainable land resources.

UVM Extension programs focus on encouraging ecosystem-based approaches to land use, which will allow sustainable production and efficient use of goods and services from renewable resources and conservation of nonrenewable resources. Some of the programs supported by Extension faculty during FY2000 include Logger Education to Advance Professionalism, COVERTS, Stumpage Data reporting, Value-added Woods Products, 4-H Volunteer Leadership Training, Forestland Owners Estate planning, Sustainable Processing and Use of Wood Resources. These and other ongoing programs continue to meet the needs of landowners, forest product business owners and youth interested in the sustainability, use and management of Vermont's natural resources.

Landowners are not aware of **estate planning** tools they can use to transfer lands within families and keep them productive. UVM Extension specialists teach woodland owners practices that they can use to provide for woodlands in their estates. As a result of this project, more than 300 owners now know more about estate planning regarding woodlands. In Vermont, owners estimate savings averaging more than \$80,000 per family.

Less than one-third of the loggers in Vermont have had any formal training in managing forests, and yet they harvest wood from more than 6,000 acres each year. Using the comprehensive curriculum, **Logger Education to Advance Professionalism (LEAP)**, UVM Extension specialists teach loggers safety and first aid, business management, ecosystems, operations, and professionalism to an average of 60 Vermont loggers each year.

The start of the **Sea Grant Extension** program in FY2000 has been a significant new addition to the Natural Resources Curriculum program team. A water quality specialist has joined UVM Extension with a solid background in natural resources management and is beginning to build a new program that will deal with watershed related issues in Vermont. Vermont's Sea Grant Extension program is seen as a new and vital link between other watershed management and education efforts that occur in the Champlain Valley. The UVM specialist is also working at the Champlain Lake watershed level so as to complement and collaborate with the new Sea Grant Extension faculty member in Plattsburgh, New York, who is focusing directly on water-based issues within Lake Champlain.

Another significant event in FY2000 was the successful receipt of a two-year grant that will support enhanced integrated, multi-disciplinary efforts between members of the natural resources team and the agricultural team over the issue of farm nutrient management. This farm level effort will integrate the work of several faculty members and cooperators to provide farmers with a more coordinated and effective way of learning about and applying nutrient

management best management practices to help sustain and protect Vermont natural resources and farming.

Sustainable water resources.

UVM Extension's natural resources team focuses educational efforts on issues regarding water quality and encouraging practices that minimize adverse impacts on water resources, including important wetlands.

A second part of the funded grant noted above also supports the work of three faculty members who are initiating a new project with the residents and officials in the Town of Colchester. The objective is to provide education and information regarding the appropriate **management and maintenance of septic systems** at seasonal lakeshore residences. Coastal camps or cottages may contribute to serious local water quality deterioration when septic systems fail. Water quality may suffer as the result of increased nutrient loads, the presence of human pathogens, the blooms of noxious algae, and other related issues. The overall goal is to define conditions and practices in homes and properties of seasonal coastal residents that may contribute to degradation of water quality and design awareness programs to correct identified problems. The activities will include defining the principal coastal water quality issues and potential sources of pollutants, develop a network of cooperators and resources that can be a source of information for residents, design appropriate and effective outreach tools and deliver outreach programs to resident, local health officers and other volunteer officials and partner organizations.

Public policy.

Critical to the success of natural resources programming is the active engagement of Vermont citizens, our stakeholders, in a comprehensive dialog regarding the issues impacting environmental quality in our state. UVM Extension specialists help to prepare Vermont citizens to understand and take responsibility for public policies relating to natural resources and the environment.

In FY2000, a major effort and success in this arena was the **George D. Aiken Lecture Series** entitled Vermont's Watersheds--Sustaining Ecological and Economic Vitality. The 25th anniversary of this program has included seminars in seven Vermont communities attended by more than 700 citizens. The lecture series focused on local issues, concerns and approaches to watershed stewardship while highlighting cultural, ecological and economic values associated with watersheds and their implication to the quality of life, environmental integrity and economic vitality of Vermont's working landscape. These lectures brought knowledgeable individuals from an array of locations to each of these communities for sharing of information and discussion on issues of importance to Vermonters.

Conflict management.

UVM Extension specialists work to enhance the skills of Vermonters in identifying and managing conflict, so as to improve natural resources/environmental management decision-making. In FY2000, this team helped to improve communication lines between and among employees within the five member organizations involving natural resources related issues. Member representatives from each organization, including UVM Extension, USDA's Farm Services Agency, USDA's Natural Resources Conservation Service, and Natural Resources Conservation Council, and the Vermont Association of Conservation Districts participated in

conflict management training. These trained members were then able to help facilitate and develop management strategies to deal with communication issues within and between member organization and also work with outside organizations dealing with natural resources related communication issues.

Natural Resources and Environmental Management Research

In FY2000, Vermont Agricultural Experiment Station (VT-AES) researchers focused their natural resources and environmental management research efforts on the following activities funded with Hatch funds:

Management of tarnished plant bug with entomopathogenic fungi. Tarnished plant bug is the number one insect pest of vegetables and small fruits in Vermont. Fungi hold promise as a biological control tool. UVM entomologists will further the development of fungi as a component of integrated pest management. They have compared the efficacy of fungi both as formulated products and pure spores and found differences in the effect of the formulation materials depending on the treatment method used. Development of effective biological controls for this pest will open up new opportunities for organic farming markets.

Factors affecting efficacy of mycopathogens in greenhouse pest management. Little is known about possible plant-mediated effects on insect infection with insect-killing fungi. The project examines host-plant effects on conidial survival on different poinsettia and tomato varieties and effects on fungal efficacy against silverleaf whitefly. Conidial survival was similar on four poinsettia varieties and was greater than 80% after 16 days. Viability declined significantly faster on tomatoes, and there appeared to be an effect on variety on survival. Effects on efficacy are now being evaluated. Such information is essential to the successful use of fungi in plant protection.

Managing parasites of pastured livestock on organic farms. Grazing livestock, especially young animals, are adversely affected by internal parasites. This project examines ways of managing parasites to reduce their effects on organic farms. Results indicate that the combination of grazing young animals through a pasture area once per season and treating their mothers with pumpkin seed extract and Duddingtonia fungus at birthing to reduce parasite egg shedding and larval survival on pasture, may decrease parasitism of the young stock. Farmers may be able to use these treatments to reduce internal parasitism of their grazing livestock.

Microbial and physio-chemical control of nitrogen mobility in forest ecosystems. Understanding what factors control the movement of nitrate through the forest ecosystem is essential to an understanding of the impacts of acid deposition. This study will focus on the forest soil microbial population and how it transforms nitrogen. Samples have been collected from eight research sites in the Northeast. Preliminary data show a wide range in net nitrification. Results should provide valuable information on the role of microbial community dynamics in watershed nitrogen mobility and provide insights on the mechanism of increased acidification from increased nitrogen deposition.

Assessing nitrogen transformations and export in two contrasting forested watersheds. Vermont's forested ecosystems may be experiencing a decline in soil nutrient status. This study examines the relationship between soil nitrogen (N), especially nitrate, and stream export of N in two contrasting watersheds. Stable isotope analysis shows a similar source of nitrate in two streams with dissimilar export patterns. Net and gross nitrogen mineralization rates in soil organic horizons were measured. Microbial processes are critical in the link between deposition N and stream export of nitrate. The results will aid in assessment of the impact of N deposition on N leaching and nutrient loss.

Soil factors influencing phosphorus availability to plants and concentration in runoff. Soil factors influence phosphorus (P) availability to plants and its concentration in runoff. Little information exists about factors governing long term availability of P to plants and how much is needed at low soil test levels. Information gained from this project will be used to improve recommendations for the use of P fertilizers while minimizing environmental harm. High P testing soils were analyzed, and the greenhouse experiment with soils of different P levels was finished this year. The end result of this project is that farmers will have more accurate and environmentally sound fertilizer P recommendations.

Balancing environmental and economic impacts of phosphorus management. Agricultural practices contribute to the problem of phosphorus (P) in water. This project's goal is to evaluate the economic and environmental trade-offs with different dairy farm P crop and feeding management practices. Outcomes to date for the study area include: Geographic Information System baseline of land uses and crop practices, detailed P-reducing best management practices (BMP) cost data, detailed farm-level financial data for three baseline farms, and a BMP attitude survey. As a result, farmers, agricultural professionals, and policymakers will have key information to evaluate financial and water quality trade-offs associated with the implementation of alternative P-reducing farm management practices.

NGA 5 – To enhance economic opportunities and the quality of life among families and communities.

UVM Extension's Family and Community Resources and Economic Development Team's mission is "to increase the capacity of communities, families, and individuals to improve their own quality of life and enhance their own economic development." In FY2000 this team focused their activities on the following priorities:

- Building civic capacity with strategies and tools to engage in public work through a variety of leadership education programs.
- Improving the family environment by offering education programs to parents, teachers, train-the-trainer volunteers, and community leaders to help families deal with communication issues, child rearing concepts, financial management, and time management.
- Creating healthy communities by improving the ability of individuals, families, and community leaders to make and implement effective social, environmental, and economic decisions.

Building civic capacity.

Rural communities need information and training in order to be effective in assessing priorities and developing strategies. UVM Extension's **Take Charge/Recharge** program is designed to enable leaders, decision makers, and residents in Vermont communities to plan for their future. In FY2000, Extension specialists engaged citizens in three communities through facilitated meetings to assess community assets, identify opportunities, and establish priorities. These initial meetings have set the groundwork for future community development programming that will take place in FY2001. Results of the activities will be reported in next year's Annual Report.

UVM Extension is enhancing the abilities of community leaders and volunteers to address urban landscape-related community issues through its **Stewardship of the Urban Landscape (SOUL) Leadership Program**. In FY2000, a 35-hour program was held in Rutland, Vermont, with 14 people completing all the requirements, including initiating a community project, for a certificate of completion. The program was also held in Colchester, Vermont, reaching 26 participants. In May, one participant played a leadership role in the installing 150 new plants, including blueberry bushes and trees, next to a stream. The project is part of a private & public sector cooperative effort to restore a riparian zone to improve water quality for the area.

In FY2000, **4-H** continued to be a UVM Extension hallmark program reaching 12,000 youth and 478 adult volunteers. Extension specialists provided a variety of educational modules to help prepare 4-H volunteers and others to teach selected leadership and life skills competencies. With 4-H Extension Educator positions supporting expansion of the 4-H program throughout the state, new 4-H leaders were trained to support 429 existing 4-H Clubs and programs and to support new 4-H opportunities.

The Vermont **4-H Camping** program provides a short-term, living experience in a safe environment, away from home, for youth and young adults. In addition, youth camp counselors learn and practice leadership skills. An extensive variety of program offerings helped youngsters learn life skills and gain confidence while learning in new environments. The FY2000 4-H camping season reached 2,125 young people between the ages of 5 and 16 and provided employment for 117 staff. \$69,000 in scholarships were raised to support 4-H youth campers.

UVM Extension's **4-H Gardening Program** helps involve experienced volunteers from UVM's Master Gardener program in educating youth in the life-long skill of gardening. In FY2000 efforts were expanded to reach 180 youth (double the 1999 program enrollment). A new component offering organic lessons has been added. The program also expanded to include a 4-H Cloverbud (age 6-7) component and a leadership and community service component for older youth. Local Rotary Club members and other volunteers visited the gardens to constructively evaluate the endeavors. 40 new volunteers were recruited and \$3,000 in donations of seeds, plants, soil and supplies were leveraged.

Through the **Expanding the Caring Community (ECC)** Project, UVM Extension continued to foster youth development by teaching life skills through creative, educational and recreational activities as well as by teaching community awareness and involvement skills. In FY2000 Extension engaged 11 targeted communities with a variety of outreach efforts. 1,367 youth were reached with life skills programming. According to program assessments, 937 of the youth reached through these programs demonstrated at least one behavioral change linked to a positive life skill. 312 adult volunteers were involved in communities projects compared to 250 in FY 99. The value of volunteer time contributed to ECC programs reached \$162,948. In addition, communities generated \$250,772 as match in support of projects and programs.

Each year more than 10,000 Vermont citizens serve their communities as local officials and volunteers. Through its **Town Government** programming, UVM Extension continues to provide training to ensure that local volunteers have the resources and information to be effective in their community roles. In FY2000, the 22nd Annual Municipal Officers Management Seminars with 30 one-hour workshops reached 770 people at four sites. The 55th Annual Town Officers Educational Conference, with 33 1-hour sessions, was held at five sites throughout the state reaching 905 local leaders and community volunteers.

Family life education.

In FY2000, UVM Extension specialists continued to deliver programming aimed at improving the family environment. Educational programs reached parents, teachers, train-the-trainer volunteers, and community leaders to help families deal with communication issues, child rearing concepts, financial management, and time management.

Extension specialists continued to support a court-mandated program "**Children Cope with Separation and Divorce.**" Specialists work with the Vermont Family Court system to help parents learn to work together and to better meet the developmental needs of their children under 18 years of age. In FY2000, 25 adult instructors were trained to deliver this 4-hour seminar throughout the state. Statewide, 2,414 parents, affecting 2,490 children, completed the program in FY2000.

A variety of parenting programs were taught in FY2000 including **Active Parenting** and **Bowen Family Systems**. These efforts helped to provide parents and childcare workers with practical information and skills regarding parenting, communications, and positive discipline. This year more than 150 adults participated in parenting programs held throughout Vermont.

Good financial practices contribute to the well being of families. UVM Extension's programs **High School Financial Planning** and **VT Money 2000** help people gain a basic knowledge of financial planning and improve their financial well being by increasing savings or reducing debt. In FY2000, three train-the-trainer programs for Money Management expanded the corps of instructors by reaching 40 employees of the Vermont Department of Employment & Training and Community Action Agencies. The change in net worth reported by 25 members of

the VT Money 2000 program for FY2000 is a \$15,360 increase in savings & a \$90,635 reduction in debt.

Community-based economic development.

In FY2000 UVM Extension helped to create and support healthy communities by providing educational programming designed to improve the ability of individuals, families, and community leaders to make and implement effective social, environmental, and economic decisions.

Women are considered an under-represented audience of USDA meaning they are less likely to apply for and use the services provided by the USDA agencies. In collaboration with UVM's Center for Sustainable Agriculture UVM Extension continued its focus on increasing the number of women and minorities owning and operating profitable farms and agricultural related business. In FY2000, the **Women in Agriculture Network** (WagN) provided education and technical assistance to individuals interested in agricultural-related businesses. Four discussion groups met monthly providing 40-50 individuals with opportunities to develop sound business practices and leadership skills. 1,200 individuals regularly received education and technical assistance that will allow them to access USDA services more effectively

While international trade offers opportunities to Vermont businesses, many small business owners lack the knowledge and skills to effectively navigate the complex international trading process. In FY2000, UVM Extension provided **International Trade** educational programs to assist small businesses to make decisions that will increase their export potential. 75 business consultations were conducted and four workshops related to export issues reaching 76 people. Four participants obtained international work as a result.

Community and Economic Development Research Highlights

In FY2000, Vermont Agricultural Experiment Station (VT-AES) researchers focused their community and economic development research efforts on the following activities funded with Hatch funds:

Building quality community-based long-term care systems. There is a need for increased medical consumerism in shaping the quality of the medical service provision. This project assesses the awareness, information, use, and satisfaction status of individuals receiving care and measures quality of care. Results for Vermont reveal that satisfaction is influenced most by the reliability and courtesy of a home-based caregiver. There are differences in satisfaction for those who live alone and those living with others. For those living alone, satisfaction with contact with family and friends also has an important impact on satisfaction with home-based care. Caregiving agencies must consider their target audiences in the provision of care. In addition, characteristics of care giving that are controllable lead to increases in client satisfaction.

Census 2000 in Vermont: An economic and demographic trend analysis. Census 2000 is the major federal government information collecting activity. Often rural and small communities do not have access to this data or to the findings that come from the data. This project is designed to bring the critical census information into Vermont in a way that citizens will find accessible and user-friendly. The information will be released in 2001. As a result of this project, resources were found to train three staff members, and a statewide network of users was developed. Not only does this address the digital divide, but it will make vital census

information regarding housing, age, gender distribution, family structure, and more available to all Vermonters.

Consumer use of and satisfaction with electronic banking services. There is an increasing proliferation of electronic banking services in the U.S. Yet, little is known about the adoption rates and satisfaction consumers have with these services. This project examines trends in consumer use of electronic banking, satisfaction, and complaining behavior associated with their use. Analysis of a representative sample of Americans reveals factors associated with the adoption of innovations are robustly associated with adoption. These include trialability, observability, relative advantage, simplicity, and compatibility. Understanding the adoption of electronic banking services allows both marketers and educators to better tailor product offerings and educational efforts in ways that aid consumers in getting the types of services that best meet their needs.

Study of the contribution, linkages to agriculture, and tax policy impacts on the tourism industry in Vermont: A general equilibrium approach. The tourism industry contributes significantly to the state income for Vermont. This project creates a CGE model to link the activities between tourism sectors and non-tourism sectors in Vermont. Surveys have been done for tourists, lodging businesses, eating and drinking businesses, and ski areas to gather financial information. A CGE model has been constructed to evaluate the economic activities focusing on tourists' contribution to Vermont economy. State officials are verifying current results including tourist numbers and expenditures, and total contribution from the tourism industry to Vermont state income. This information will be used to modify the promotion plan for tourism industry, and to implement associated policies impacting on tourism industry.

Effective rural development strategies that optimize community-business matches. A Community-Business Matching Model has been developed for the project to help rural communities prioritize their goals and examine their assets relative to sustainable economic development, and gain information about the types of businesses that are most likely to match those goals and assets. The model has been successfully implemented in two Vermont communities. Modifications have been made to the model to correct the limitations identified in the second study. The database containing location decision information has been expanded to include 557 small- and medium-sized businesses in sixty-two 2-digit SIC sectors. Computer software and a user-manual have been written to facilitate the implementation of the decision model in rural communities.

Multi-State Activities

As part of the national land grant system, the University of Vermont Extension and Agricultural Experiment Station are involved in a variety of multi-state outreach and research activities that address the five national goal areas.

Agriculture. In competitive agriculture, UVM researchers are continuing long-term collaborations with Cornell to develop and field test new apple cultivars that will eventually improve the hardiness and quality of Vermont's apple crop. UVM Extension, as a part of the UVM Apple Team, plays a significant role in connecting apple growers to ongoing research and up-to-date information resources. UVM-hosted Internet websites are becoming an increasingly effective method for distributing technical and marketing information to apple growers within Vermont and beyond the state's borders. Other multi-state collaborations include:

- Working with New Hampshire to plan, teach and evaluate agricultural business management courses.
- Organizing an annual dairy herd management conference with colleagues from Connecticut, New Hampshire and Maine.
- Participating in the New England Green Pastures program to recognize outstanding New England farmers (Rhode Island, Maine, Connecticut, New Hampshire, and Massachusetts).
- Developing and distributing vegetable management guides and small fruit pest management information as part of the New England Vegetable and Berry Extension Consortium (with Maine, Connecticut, New Hampshire, and Massachusetts).
- Conducting soybean field trials and developing information resources with experts from Maine, New Hampshire, and New York.

Agricultural research faculty will continue to contribute their expertise in areas defined by active regional research projects including:

- Organizational and Structural Changes in the Dairy Industry (NE-177)
- Multi-Disciplinary Evaluation of New Apple Cultivars (NE-183)
- Regulation of Nutrient Use in Food Producing Animals (NE-148)
- Mastitis Resistance to Enhance Dairy Food Safety (NE-112)

Food Safety. UVM researchers will continue to pursue the development and maintenance of multi-state collaborations in the area of food safety. The states of the Northeast Region share many attributes: small geographic size, declining manufacturing industries, growing service and tourism-related industries, and an agricultural heritage that is threatened or in decline. Of particular interest is the growing industry of specialty food processing which is establishing a significant niche in the value-added agricultural products market. The region's food industry is generally characterized by small and medium sized operations producing a variety of specialty foods. The tourism industry plays a major role in all of the state's economies and employs more than several thousand people, many in seasonal operations, and many in operations where food is processed and shipped or served to customers.

For the past several years, UVM Extension food safety specialists have collaborated with other New England states on a variety of initiatives funded by USDA. With limited personnel and financial resources, it is to each state's advantage to work toward cooperative programming that augments each of the partner's resources allowing them to make greater impact.

Listed below are some of Extension's collaborative New England food safety efforts. Base funding continues to sustain these programs as UVM Extension nutrition, food safety and health faculty and staff are implementing them.

- SAFE I (Safety Awareness in the food Environment), University of New Hampshire (UNH) and University of Vermont (UVM). This project involved the development of a food safety and sanitation curriculum geared to food managers in the food service industry and the publication of the Risky Business Newsletter (this newsletter currently has a mailing list of 6000 food managers in NH/VT). The curriculum was just revised and reprinted and continues to be used extensively in NH and VT to train food service personnel.
- SAFE II This project involved UNH, University of Connecticut (UCONN), University of Rhode Island (URI) and UVM. It involved the development of a food safety and sanitation curriculum geared to the volunteer food service worker (i.e. the chicken pie supper people). In 1997 this curriculum was promoted in the a national publication entitled Food Protection and in 1998 was endorsed by the Conference for Food Protection (CFP), the Federal Drug Administration (FDA), Food Safety and Inspection Service (FSIS), USDA, CSREES as the training manual to be used nationally to train volunteer food service workers and managers of temporary food establishments.
- The New England Food Safety Project. This involved the food safety contacts from all the six New England States. The focus for this project was the specialty or small food producer. A HACCP based curriculum for small food producers and a newsletter, which was distributed to all specialty food producers in New England, was produced under the direction of the project coordinator housed a UME. Five regional HACCP workshops for small and specialty food producers in New England were held. Additional workshops are anticipated in the future as needed with support from all partner institutions.
- A Food Safety Hotline for consumers, housed at URI but accessible to all New England residents, has been established and is supported through base dollars.
- UVM Extension food safety specialists with their URI counterparts have developed and piloted a curriculum for high schools that uses a community service learning methodology to teach food safety.
- UCONN, UVM, UNH and URI joined forces to develop HACCP workshops for Cider producers in New England. Future collaborative workshops are anticipated.
- In collaboration with UCONN Extension faculty, UVM food safety specialists have developed and field tested a food safety curriculum for 4H youth entitled "Food, Flies and Fungus." The curriculum is based on the experiential learning methodology.

In 1998 and 1999, UVM Extension faculty expanded their collaborative scope to include the land grant institutions in New York, New Jersey and Pennsylvania. The Cornell Fruit and Vegetable Project includes all the land grant colleges in the northeast including Vermont. The goal for this project is to reduce microbial contamination on fruit and vegetables produced in the Northeast. Contingent on funding, in 1999 these activities will be expanded to include food safety projects with Wisconsin, Alabama and West Virginia.

Natural Resources and Environmental Management. Multi-state activities in this area will continue to focus on the important linkages between productive agriculture and wood products industries and the protection and maintenance of environmental quality. Current activities include:

- Working with Massachusetts and Virginia on a program addressing issues of harvesting, manufacturing and marketing of character marked wood furniture.
- Continued networking, development and sharing of educational program information with colleagues from Connecticut regarding farm-based tourism.
- Working with experts from Massachusetts and New Hampshire to provide courses, internships and grower meetings regarding vegetable and small fruit integrated pest management.
- Participation in a plant diagnostics clinic with New Hampshire, New York and Massachusetts in weed, insect and disease identification and recommendations for pest management strategies.

Family and Community Development. In FY2000, UVM Extension's Expanding the Caring Community (ECC) project continued to be the focal point of ongoing participation in the Children, Youth and Families at Risk (CYFAR) initiative funded by CSREES/USDA. The CYFAR initiative has linked Extension and research faculty from virtually every state in the nation. Internet-based electronic networks of programming and technical information provide faculty with access to technical assistance and support in the development and assessment of community programs that address locally defined quality of life issues for children, youth and families. As active members of the National Network for Collaboration and the National Network for Family resiliency, UVM Extension faculty members provide training and support to other land grant institution colleagues.

Integrated Activities

An effective method of integrating research and Extension activities at the University of Vermont is through the split appointment of faculty. At present there are faculty with split appointments in the following departments: Animal Sciences; Community Development & Applied Economics; Plant & Soil Science; and Nutrition & Food Science. In addition to teaching and research, faculty members are assigned to Extension curriculum/program teams and play active roles in developing and implementing outreach programs.

In the area of agriculture, Vermont has developed an integrated orchard management approach in which horticultural and pest management aspects have been interwoven in extension and research activities. The UVM Vermont Apple Program emphasizes a team approach. The team includes a pomologist, an IPM specialist, qualified technical personnel, and graduate and undergraduate students. The program features one-on-one interactions with apple growers, orchard demonstrations, meetings, workshops, publications, active research in commercial orchards, and development of Internet web sites for education and information delivery. The UVM Apple Team provides the scientific and technical expertise necessary to help apple growers remain competitive in local, national and international markets while maintaining a sustainable agricultural system.

To encourage greater collaboration and integration between UVM research and Extension faculty, a pool of targeted funds has been developed to support a competitive grant proposal process—The Vermont Integrated Research and Extension Award (VIRECA). Research proposals are merit and peer reviewed by a panel consisting of research and extension faculty as well as stakeholders representing research and extension constituencies. Eligible research proposals must be clearly linked to at least one the five national goal areas and priority areas identified by our advisors and stakeholders. These priorities include:

- Food Safety
- Food Security--increasing local consumption of Vermont grown foods
- Rural Communities--the Working Landscape and Workforce Development
- Water Quality--reducing non-point source pollution, alternative nutrient management and feeding management strategies

In FY2000, two three-year awards were made. One project is dedicated to the examination of the cold-hardiness of the western flower thrips, a common greenhouse pest. The second project explores the use of touch-screen computer technology in the delivery of health and nutrition information to senior citizens. A second round of three-year awards will be made in FY2001.

UVM Extension and Agricultural Experiment Station Total Resources for FY2000

In FY2000, 32% of the Vermont Agricultural Experiment Station expenditures were supported by the state and 22% was supported by federal Hatch dollars (including multi-state research funds). The single largest source of support for UVM Extension is determined by the State of Vermont appropriation to the University of Vermont. For each dollar the Vermont Legislature appropriates to the University, UVM Extension receives 12 cents. In FY2000, approximately 48% of Extension's resources came from state coffers.

State support and federal matching funds (Smith/Lever and Hatch) assist both Extension and research faculty in securing other competitive funds and partnerships. For example, in FY2000, Vermont AES researchers were awarded approximately \$3 million in competitive grants and awards--an 84% increase from FY1999. UVM Extension faculty were also awarded more than \$1.5 million in grants and contracts.

The following two tables summarize the fiscal and human resources marshalled by the University of Vermont Extension and Vermont Agricultural Experiment Station in addressing the five National Goal Areas as defined by the Agricultural Research, Education and Extension Act of 1998 (AREERA). Human resources are defined as full-time equivalents (FTEs) for faculty (professional) and technical staff (paraprofessional). Fiscal resources represent an accounting of those federal dollars (Smith/Lever (b), (c), and Hatch) and State of Vermont matching dollars as required by AREERA. Fiscal resources expended on multi-state and integrated activities are documented on the attached CSREES forms.

FY2000 Human and Fiscal Resources

Human Resources FY 2000	Extension		Agricultural Experiment Station		Total
	Professiona l FTEs	Para- professional FTEs	Professional FTEs	Para- professional FTEs	
1 – Competitive Agriculture	15.87	2.38	20.38	5.68	44.31
2 – Food Safety	1.5	0.22	3.21	0.0	4.93
3 – Human Nutrition	4.07	0.0	6.54	0.0	10.61
4 – Ag and Natural Resources Harmony	5.32	0.88	12.02	3.96	22.18
5 – Family and Community Resources	8.11	4.86	6.0	0.0	18.97
TOTAL	34.87	8.34	48.15	9.64	101.0

Expenditures for FY2000	Extension		Agricultural Experiment Station		TOTAL
	Federal	State	Federal	State	
National Goal Area					
1 – Competitive Agriculture	649,625	649,625	746,191	618,897	2,664,338
2 – Food Safety	54,267	54,267	55,556	148,201	312,291
3 – Human Nutrition	146,723	146,723	219,918	178,881	692,254
4 – Ag and Natural Resources Harmony	243,126	243,126	284,025	447,775	1,218,052
5 – Family and Community Resources	383,259	383,259	99,373	310,619	1,176,510
TOTAL	1,477,000	1,477,000	1,405,063	1,704,373	6,063,436