# Virginia Tech and Virginia State University
# Agricultural Research and Extension
# FY 2005 Annual Report of Accomplishments and Results

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# A. Introduction

## Mission

Virginia Cooperative Extension (VCE) and the Virginia Agricultural Experiment Station (VAES) enable people to improve their lives through research and an educational process that uses scientific knowledge focused on issues and needs.

## Vision

Building on the strength of our agriculture, natural resources, family and community heritage, we enable people to shape their futures through research-based educational programs. Recognizing that knowledge is power, we serve people where they live and work. Audiences are involved in designing, implementing, and evaluating needs-driven programs. We are a dynamic organization which stimulates positive personal and societal change leading to more productive lives, families, farms, and forests, as well as a better environment in urban and rural communities.

Our vision is:

- To develop and transfer new knowledge in applied and basic life sciences.
- To perform research, which is relevant, objective, and timely.
- To help clientele improve their lives.
- To use a systems approach to programming, with task-oriented work teams that respond to the needs of individuals, groups, and organizations.
- To provide residents prompt access to information and programs through an innovative human and technological system.
- To work with the disenfranchised and underserved who need special attention by targeting certain of our resources to programs for low-income groups, those outside the dominant culture, dysfunctional families, limited-resource farmers, at-risk youth and others.
- To fully integrate a culturally diverse paid and volunteer staff in planning, implementing, and evaluating programs.
- To collaborate with public and private partners to better utilize our resources, heighten our impact, and reach a more diverse audience.
- To capitalize on the respective strengths of Virginia State University and Virginia Tech as partners in supporting the Extension mission.
- To recruit, manage, and reward faculty and support and volunteer staff to reflect each person's uniqueness and value.
- To have an open and positive administrative environment, based on shared leadership that maintains organizational integrity while providing opportunities for all staff members to fully realize their potential.
- To minimize administrative costs and direct our resources to research educational programming.

## Planning and Reporting Framework

**Program Development.** VCE and VAES address a broad range of problems and issues facing citizens of the Commonwealth through focused research and educational programming. This is accomplished and reported in VAES through CRIS and the VCE Planning and Reporting system, which include long-range goals made operational by annual program plans and reports. The foundation upon which research and Extension program plans are built is the identification of strategic issues through situation analysis, accomplished with the help of local Extension Leadership Councils. Situation analysis is a process of collaboratively determining what problems exist at local, regional, and state levels, and then deciding which ones are issues of major public concern. The situation analysis becomes the background and rationale for deciding which problems and issues can be addressed with VAES and VCE time, energy, and resources.

The VAES/VCE program planning and reporting system is web-based and includes goals, educational programs, objectives, strategies, and data and information required for reporting.

**VAES/VCE Goals.** Strategic goals form the foundation upon which research and educational programs are developed. Goals are determined with the involvement of Extension Leadership Councils, cooperating agencies, local governments, and other stakeholders and partners.

Our strategic goals are:

- Virginia's agricultural, forestry, and agribusiness firms will be competitive and profitable.
- Virginia's youth will be educated leaders for the 21st Century.
- Virginia's natural resources will be enhanced.
- Virginians will have a high-quality, safe food supply.
- Virginians will enjoy a good quality of life.

**Educational Programs.** VCE educational program plans serve as a communications and planning tool for developing, delivering, and reporting VCE programs. They are used to communicate information about VCE client-focused programs within the system and to external audiences such as the state and federal government officials.

Once approved, the educational programs are available on the VCE Intranet so all staff may review and respond. Personnel respond ("buy in") to the appropriate educational programs by indicating the programs they plan to deliver. At the end of the programming year, an annual report is prepared for each educational program. In addition, staff is able to amend or update their buy-in annually, or as often as needed.

**Research Objectives.** Our primary goal is to develop relevant basic and applied research data that will help form the basis for Extension programming. A wide range of long- and short-term research projects are undertaken to provide a continuous flow of new knowledge and seamlessly provide science-based information to enhance the quality of life for our citizens.

**Educational Objectives.** Objectives describe the level of change expected in the target audience and/or the problem as a result of implementing the program. The following categories represent four types of change that may occur:

- Reactions - Changes in peoples' awareness and response to educational programming and information related to the problem.
- Knowledge or skill (K/S) change - Changes in peoples' knowledge, understanding, or abilities related to the problem.
- Practice change - Changes in peoples' behavior related to the problem.
- End results - Broader changes in peoples' situation related to prevention, reduction, or solution of the problem itself.

Reactions, knowledge/skill (K/S), and practice changes focus on people. End results can focus on people or problem solution. An objective expecting an end-result is often difficult to achieve in only one year of programming.

**Research Strategies.** VAES has identified six key program areas as a focus for development and investment:

- Agricultural and Environmental Sustainability
- Food, Nutrition and Health
- Biodesign and Bioprocessing
- Green Industry -- including nursery and turf
- Infectious Diseases
- Community Viability

These program areas support key national goals by addressing local, regional, and national problems through relevant basic and applied research. Research-based information and solutions to specific issues are then taken to the people through the educational programs of Virginia Cooperative Extension.

**Educational Strategies.** Educational strategies are the methods used with the target audience(s) to achieve the objective and address the problem. Some examples of strategies include: panels, group discussions, tours, lectures, workshops, seminars, and demonstrations. Educational strategies also include any programming efforts aimed at racial/ethnic groups, women, and/or other previously under-served or under-represented groups specifically targeted for special attention in the program.

## Reporting Requirements

All Extension faculty (agents, specialists, and administrators), and program assistants must submit individual reports. Also, county/city employees supervised by Cooperative Extension and who conduct Extension programs must submit program reports. Summary reports are developed from the individual reports.

All research faculty are required to prepare an Experiment Station project that is peered reviewed and submitted to USDA/CSREES and entered into the Current Research Information System (CRIS). The researchers' prepare the annual progress and termination reports (AD-421), which are reviewed by the VAES Director before being submitted to CRIS. In addition, all research and Extension faculty are required to submit a web-based annual report through eFARS, the electronic Faculty Annual Reporting System. This locally developed system documents the teaching, research, and Extension accomplishments and impacts for unit and college review.

## Data Summary for 2004-2005 Programs

Table 1 presents a summary of contact and volunteer data from the VCE Planning and Reporting System by Extension program area. (Note that this is an 18-month period rather than 12 months. This lengthened reporting period was necessary to change our reporting cycle to a calendar year basis.)

There were 6,357,763 contacts in VCE programs during the period July 1, 2004 through December 31, 2005, including 33,827 volunteers assisting Extension staff in delivering programs during the reporting period**.** The total value of volunteer time contributed to Virginia Cooperative Extension educational programs (891,875 hours estimated at a value of $17.79 per hour according to the Virginia Employment Commission) was $15,866,456 for this reporting cycle.

**Table 1. 2004-2005 Contacts and Volunteer Data by Program Area (July 1, 2004 through December 31, 2005)**

| Program Area | Total Contacts | Percent of Total | Volunteers | Percent of Total | Volunteer Time (hrs) | Percent of Total |
|---|---|---|---|---|---|---|
| 4-H | 1,697,874 | 26.7% | 19,729 | 58.3% | 513,357 | 57.6% |
| ANR | 4,336,632 | 68.2% | 7,537 | 22.3% | 270,370 | 30.3% |
| CV | 17,370 | 0.3% | 494 | 1.5% | 20,194 | 2.3% |
| FCS | 269,913 | 4.2% | 5,911 | 17.5% | 81,388 | 9.1% |
| Admin. | 35,974 | 0.6% | 156 | 0.4% | 6,566 | 0.7% |
| **Totals** | 6,357,763 | 100% | 33,827 | 100% | 891,875 | 100% |

There were 906,000 extended learners who spent at least four hours (six hours for 4-H membership) per year in VCE educational programs. A variety of delivery modes including conferences, workshops, home-study courses, web-based and other distance-delivered programs, public fairs, home/family shows, and exhibitions were used in these programs. A total of $15,253,974 external dollars were provided for the four program areas.

# B. National Goals

## Goal 1: To achieve an agricultural production system that is highly competitive in the global economy

Continued research (basic and applied) and Extension programs in agricultural production systems are vital if the U.S. is to continue providing safe, nutritious, and affordable food to consumers. Research, development, and education, are vital for the U.S. to compete effectively for export markets or to achieve greater harmony between agriculture and the environment. Agricultural research and Extension keeps America strong and is the principal catalyst for economic development and environmental protection.

Work stretches across many areas and themes from inventing and implementing value added systems and practices for livestock and crop producers to developing alternative uses for crop residues and animal wastes. With radical changes in tobacco production and commodity based industries, successful agricultural enterprises will be those that stimulate economic development and capture value added incentives.

New opportunities exist in bio-based products with producers serving as the provider of raw materials for fuel, industrial products, and functional foods. Agricultural crops and wastes will provide new products such as bio-oils, fertilizer, and serve as fuel for energy needs. High value crops, direct marketing, and regional food marketing alliances will provide additional profits and opportunities for producers.

Competitive farmers, fishermen, and agri-businesses with adequate knowledge and tools can ensure that: 1) livestock, dairy, poultry, and seafood enterprises thrive, 2) consumers get safe and nutritious food, 3) animal health and well being is enhanced, and 4) crop and animal wastes are used for bio-based energy, industrial, and other valuable uses.

Investments in crop and plant research are the keys to food security and are crucial to maintaining a diverse food and fiber supply. To sustain high levels of production and ensure a healthy environment, agriculture will have to be profitable, environmentally sound, and research-based. Increased productivity depends more and more on genetic resources and biotechnology coupled with sustainable management practices to protect the environmental integrity of natural resources. Innovation, entrepreneurship, and multidisciplinary approaches to problem solving will insure agricultural profitability and environmental sustainability.

The two land grant universities work in concert to assure competitiveness in Virginia's agriculture and beyond. The Commonwealth's agriculture continues to be challenged by pressure from urbanization, the fast pace of new technology, low commodity prices, reductions in farm support programs, labor issues, new and changing regulations, and the seeming indifference of the general populace towards the value of local agricultural enterprises. Such are the challenges of research and Extension personnel who put new knowledge to work every day throughout the Commonwealth.

Research activities at the two land-grant universities account for approximately 300 CRIS units with typically 60% of that portfolio focused partially or wholly on topics related to Goal 1. The effort to achieve and maintain a globally competitive agricultural productive system requires a continuing commitment of resources, hard-working and dedicated people, a focused vision, and a resolve to succeed. The state and federal partners join forces to work in these positive directions.

Research and Extension outputs generated as part of this goal included: 166 refereed journal articles, 21 books and book chapters, 41 numbered Extension publications, 10 Extension bulletins, 24 theses and dissertations and 118 other reports.

This section highlights the 2005 accomplishments of Virginia Tech and Virginia State University in achieving an agricultural production system that is highly competitive in a global economy. Twelve theme areas are included in Goal 1:

- Agricultural Competitiveness
- Agronomic and Forage Crops
- Animal Production Efficiency
- Aquaculture
- Biobased Products and Processing
- Biotechnology
- Diversified/Alternative Agriculture
- Integrated Pest Management
- Invasive Species
- Manure and Nutrient Management
- Niche Markets
- Plant Disease Management

## *Key Themes*

### *Agricultural Competitiveness*

**Management Systems to Improve the Economic and Environmental Sustainability of Dairy Enterprises.** Dairying requires extensive investment and is prone to periodic cash flow deficits due to volatile milk prices. The cost of securing replacement heifers represents 20 percent of expenses and is a detriment to profitability when heifers are not reared efficiently. The purpose is to improve economic returns from the dairy enterprise through enhanced management of cows in early lactation and efficient growth of replacement heifers under modern environmental constraints. Short supply and high demand has increased the cost of 2-year-old replacement dairy heifers from 1,200 to 2,000 dollars in recent years. That has nearly doubled the cow depreciation experienced by dairy producers as they replace 30 to 40 percent of their cows each year. Feeding heifers to grow more rapidly to maturity effectively reduces replacement costs by about 8 percent annually. A herd of 1,000 cows will save 135 dollars per replacement heifer from earlier maturity at a cost of 80 dollars, and thereby retain 19,250 dollars per year on a group of 350 heifers. Feeding the 28:20 milk replacer will also reduce calf mortality by 10 to 15 percentage units, matching the dollars saved by more rapid growth. Data from this study will contribute to

achievement of those savings through more efficient rearing of heifers and more accurate models of heifer growth developed here and at Cornell and other institutions.

**Virginia Beef Quality Assurance Program.** The Virginia Beef Quality Assurance Program provided education and certified beef producers in best management practices that improve the safety and quality of beef. One thousand twenty-seven Virginia beef producers obtained initial or re-certification during 2005. This brings the total number of certified producers in Virginia to 3,049, and establishes Virginia as a national leader in beef quality assurance. In 2005, 10,795 calves were marketed through the program. Producers received a premium of $42.27 per calf, resulting in $456,273 of additional income for Virginia beef producers.

**Southside Virginia Beef Expansion Initiative**. Southside Virginia farmers faced a changing economy and reduced income with the decline of tobacco production. Many of these farms are turning to beef cattle production as an alternative to supplement farming operations. With increases in beef production, producers identified a need for more education on forage and beef management and a need for genetic and handling facility improvement. Virginia Cooperative Extension proposed the Southside Beef Initiative. The Virginia Tobacco Commission provided $380,000 for the initiative which provided cost-share dollars for 76 producers to invest in genetically superior stock and upgrades in animal working facilities. For every $1 million generated in cattle sales, it is estimated that approximately 13-17 jobs will be created in Southside Virginia.

**Improved Cattle Reproductive Management.** Beef producers need to utilize best management practices including superior genetics and improved reproductive techniques. In order to improve animal efficiency and production additional skills and in-depth training was required. Virginia Cooperative Extension conducted a two day Beef Cattle Reproductive Management Workshop for 27 producers. As a result of the school, 17 producers plan to use reproductive synchronization or artificial insemination with their own cattle herds. Ninety-six percent reported improved or greatly improved understanding of reproductive management and artificial insemination. Fifty-five percent report they are very confident in using reproductive management and artificial insemination of cattle while only nine percent still find using these methods confusing or difficult.

**Modeling Management of Lactation and Reproduction to Increase Profit from a Dairy Enterprise.** Dairy farms expand in size to increase net income and financial flexibility to survive tight margins and volatile prices for milk and feed. This project simulates a strategy of managing the number of days cows are in milk, relative to the days they are dry, to increase annual net cash income and profit without investment in new facilities for the milking herd. Optimum strategies can be determined for different herd characteristics and economic situations. Strategies of early dry-off can produce a modest increase in profit for herds that cannot milk more cows but have excess capacity for dry cows. In those herds, especially family farms with pasture, drying cows off at milk yields as high as 13 or 18 kg per day can net 2000 dollars per 100 cows. Drying cows off at 23 kg/d, however, reduces profit. Early dry-off with longer dry periods is suitable only for specific herd circumstances, as some herds would benefit from shorter dry periods. Although calf illness should always be of concern, this study indicated that managers should be especially attentive to illness in calves born in the spring months, as it delayed calving by as much as 2 mo.

The maintenance expense of an individual heifer is 35 dollars per month of delay in calving. Although these economic implications are modest for an individual heifer, a 2000-cow herd will calve 600 replacement heifers per year, at an annual loss of $21,000 from a delay of 1 mo in age at first calving due to calf disease.

**Revitalizing Feeder Cattle Markets.** The rolling hills in Virginia's Northern Piedmont are well suited for the production of beef cattle. Cooperative marketing of commingled, quality feeder cattle has a long history in Culpeper County with sales in place since the late 1950's. Sale numbers peaked in 1990 at 10,000 head, with the low coming 10 years later at 1500 head. Area marketing opportunities declined to a point in recent years where only a couple of sales were marketing small numbers of low quality feeder cattle. Virginia Cooperative Extension working with producers revitalized the marketing program which resulted in 4,000 head of quality feeder steers and heifers marketed in 2005. One-hundred fifty-seven producers, which represents 60 more than in 2004, from 15 different Virginia counties benefited from this marketing program which grossed $2.7 million.

**Enhancing Agricultural Investment in Southwest Virginia.** Tobacco production in Southwest Virginia has been reduced by 40 percent as a result of the tobacco buyout and loss of price support. Producers needed opportunities and resources in order to invest in alternative enterprises and to seek additional sources of income. Virginia Cooperative Extension agents in the counties of Grayson, Lee, Russell, Scott, Smyth, and Washington with the help of Virginia Tech Animal Science specialists proposed the Southwest Beef Initiative. The Virginia Tobacco Commission provided $574,000.00 for the initiative, which provided cost-share dollars for producers to invest in genetically superior breeding stock and upgrades in animal working facilities. As a result of the educational and cost-share programs, beef producers in the tobacco area have received $495,000.00 in cost share funds while making investments of over $1,000,000.00 in improved bulls and heifers and improved handling facilities.

**Increasing Livestock Marketing Opportunities.** In far Southwest Virginia there were no local markets to sell sheep and goats within a two hour drive. As a result of Virginia Cooperative Extension efforts with producers and the local livestock market, two special goat and sheep sales were offered in 2005. Sixty producers sold 420 goats and sheep that generated $25,000.00. The special marketing program and the improved quality of the animal offerings resulted in a $5.00 premium per head compared to normal market channels.

**Increasing the Slaughter Capacity in Central Virginia.** For large and small livestock producers there is a very limited slaughter capacity in Virginia. In 2005, four informational meetings were held to educate livestock producers about the feasibility of establishing a Central Virginia meat processing center. As a result of Virginia Cooperative Extension's earlier work in 2004, a feasibility study had been completed. As a result of further Extension efforts with agri-businesses and producers, livestock producers are finalizing a business plan and creating a new entity to generate resources to build a slaughter facility which would process 25 head of cattle a day in Central Virginia. Once completed the facility will provide a needed service to add value to area livestock and provide new economic development in rural Virginia.

**Direct Marketing of Slaughter Cows.** Producers can receive increased value by commingling animals and marketing in larger groups. Virginia Cooperative Extension worked with producers to pool cull slaughter cows in load lots and to sell by grade and yield directly to slaughter facilities. As a result, participating producers received a $3/cwt. premium for source verifying the cows over cows which were not in the program.

**Increased Value for Beef Heifers.** With Virginia Cooperative Extension leadership and educational programming, 18 producers cooperated to produce and add extra value to 114 bred heifers. The cattle had and initial value of $675.00 per head. As a result of the program which included estrus synchronization and breeding to superior sires, the 114 head sold for an average price of $1390 per head. As a result of the Extension program producers were able to double the value of their beef products.

**Forum for Rural Innovation.** Farm numbers in Loudoun County increased 61 percent since 1997 and similar trends can be seen in jurisdictions throughout Northern Virginia, the Northern Shenandoah Valley, and the Pan Handle of West Virginia. The trend has created a large number of small and/or part time farms as well as a growing customer base for agricultural products. Virginia Cooperative Extension worked with the agricultural development offices in Clarke, Fauquier, Frederick, Loudoun, and Jefferson (West Virginia) counties to address agricultural producer needs on a regional basis. As a result the groups partnered to sponsor a six hour educational program, "The Forum for Rural Innovation." One-hundred ninety-four producers representing three states received training which showcased replicable and innovative ideas that can enhance farm or rural business profitability and develop new approaches that are viable in an expensive farm and upscale consumer market. Thirty percent of the learners indicated they plan to incorporate the ideas and practices obtained through this program immediately, while 71 percent plan to implement the approaches within the next year.

**Economic Diversity and Sustainability in the Shenandoah Valley.** For the Mennonite community in the Shenandoah Valley and families who rely on dairy and poultry as their primary farming operation, economic pressures and environmental challenges made it more difficult and expensive to get in and stay in the dairy and poultry business. In 2005 Virginia Cooperative Extension led efforts and worked with producers to establish the weekly vegetable and produce auction which provided marketing opportunities for over 200 growers from within a 100-mile radius of the Harrisonburg and Dayton area. Through Extension programs, the Shenandoah Valley Produce Auction was formed to help young producers get into or stay in farming. The Shenandoah Valley Produce Auction exceeded $400,000 in sales in 2005. Individual grower gross sales ranged from $500 to nearly $25,000. Two new service and equipment supply businesses also started as a result of the auction. These businesses reported gross sales of approximately $100,000 in 2005. Early in the growing season, one agri-business sold eight tractor mounted spray rigs to growers valued at $3,250 each. Another company installed four miles of plastic mulch for area vegetable growers. An additional enterprise was the catering business that provided food to auction participants. As a result of the success in 2005, $200,000 was pledged for the purchase of land and the construction of a permanent auction facility and membership in market group increased from 39 to 52 growers.

**Value Added Marketing to Improve Farm Sustainability.** Double digit population growth, sky rocketing land values, and increasing energy and labor costs reduce farm sustainability in much of Northern Virginia. Improving farm sustainability through increased farm revenues is a goal of Virginia Cooperative Extension. The number of farms has increased from 933 to 1,516 (+61 percent) since 1997, while the number of acres devoted to agriculture has declined by 18 percent since 2002 in Loudoun County. Increasing numbers of small farms cannot rely on commodity based sales or an economy of scale to sustain or increase farm revenues. Virginia Cooperative Extension working with local producer groups, and livestock markets facilitated value added marketing opportunities that allowed producers to increase gross farm revenues. Five state graded sheep and goat sales sold over 1,800 head which averaged an 11 percent premium over animals sold the same week in barn sales. A bred ewe and lamb sale allowed producers to market breeding stock at an average of $357 or a 238 percent premium over in-barn weekly sales. Two specialty meat goat sales marketed 160 head of breeding stock at a premium of nearly 300 percent compared to in barn weekly sales. An elite bull and replacement cattle sale allowed producers to sell 239 head posting a $1306.26 average which was above normal markets. As a result of Virginia Cooperative Extension cooperative programs, producers had competitive markets which increased net profits.

**Commodity Marketing Research and Producer Recommendations.** Virginia's livestock and crop producers needed unbiased recommendations and proven strategies when considering the marketing of commodities and price risk management. Virginia Cooperative Extension provided a weekly on-line market advisory and recommendation report for agricultural producers. The "Purcell Market Report" web site recorded 63,000 client contacts and was published and linked to 21 other agricultural websites. As a result producers in Virginia and in other states received current and unbiased information to use in order to make cash and marketing decisions using risk management tools such as futures. Twenty-one clients were multi-state and international contacts.

**Marketing Agriculture Commodities.** Access to markets and having a marketing plan are essential to the sustainability of agriculture enterprises. Virginia Cooperative Extension led producers to establish the Shenandoah Valley Marketing Club. Thirty eight producers completed an introductory marketing training and 16 members completed additional training in options and contract. Sixteen attended the Marketing Club on a monthly basis. Participating farmers used commodity contracts to manage their price risk for the first time in 2005. One farmer reported that commodity hedging earned him an additional $8,000 this year alone. Another farmer reported that while his operation was not large enough to justify using futures contracts, the marketing club helped him make more informed decisions about selling his cattle.

**Breeding and Genetics of Barley and Wheat for Increased Productivity, Value and Durability.** Development of plant varieties with disease and insect resistance ensures an ample, safe and high-quality food supply with less reliance on pesticides. The primary goal of this project is to provide producers with wheat and barley varieties possessing superior end-use traits and resistance to pests. In 2005 winter hulled barley grain was exported to foreign markets for the first time in many years, which can be attributed to production of higher quality varieties developed at Virginia Tech as well as good production conditions. Wheat varieties developed at Virginia Tech are grown throughout much of the eastern soft wheat production region and have a

significant impact on the agricultural economy. Wheat varieties such as McCormick, Roane and Tribute, having moderate resistance to Fusarium head blight, are grown widely in areas prone to this disease. Conservation and viability of agriculture production in the eastern U.S. requires the availability of crops and varieties having high value end-use traits, which is a primary emphasis of the breeding program. Increased emphasis and need to develop renewable fuel stocks is one of the focal points of our hulless barley breeding program. Foreign export markets also have expressed interest in obtaining hulless barley. Millers in the eastern U.S. have expressed interest in obtaining locally grown bread wheat varieties to meet a portion of their supply needs. Increased demand for ethnic foods, such as tortillas, also provides the opportunity for new markets for wheat and barley produced in the eastern U.S. Development of varieties that meet the needs of these markets will provide new and higher value crops to producers and end users.

***Agronomic and Forage Crops***

**Pasture-based Beef Production Systems for Appalachia.** Virginia has over three million acres of agricultural pasture land devoted to livestock production. In 2004, the sale of cattle and calves resulted in over $317 million in gross receipts for Virginia cattle producers. The use of more legumes, combining forages, and the improved management of forages and cattle would contribute to increased efficiency and greater economic returns for small-scale producers in Virginia. The Pasture-based Beef Production Systems for Appalachia project, a joint effort among Virginia Tech, West Virginia University, University of Georgia, and the USDA-ARS is designed to develop economically viable pasture-based beef production systems, from conception to consumption, that ultimately produce pasture finished beef calves with the carcass merit and quality demanded by the consumer. The Southwest Virginia AREC is conducting research in cow-calf forage systems, pre- and post-weaning calf health and nutrition, heifer development on forages from weaning to breeding, conventional feedlot finishing, and the economic analysis of the cow-calf production systems. Seven Virginia Tech faculty members from Animal and Poultry Sciences, Crop and Soil Environmental Sciences, Agricultural and Applied Economics, and the Virginia-Maryland Regional College of Veterinary Medicine are currently conducting research in these areas. Agricultural producers from Virginia and surrounding states have attended field days and special producer meetings to learn about the preliminary results of these projects, the pasture finishing projects conducted by USDA-ARS, and meat analysis conducted by the University of Georgia.

**Assessing the Forage Potential of Crabgrass and Seeded Bermudagrass in Virginia.** Commonly used cool-season grasses have decreased production during the summer months. This project evaluates the ability of crabgrass and seeded bermudagrass to supply forage during the summer months. The sale of improved seeded bermudagrass cultivars in Virginia and North Carolina has increased from almost none in 2001 to over 20,000 kg in 2005, resulting in the establishment of more than 4,000 ha of seeded bermudagrass. Incorporation of bermudagrass and crabgrass into forage systems would allow for sustainable summer grazing of ruminant livestock in the northern transition zone and provide needed rest for traditional cool-season pastures, which will result in stronger pasture sods, reduced erosion and increased animal production per unit area.

**Enhancing Hay as a Cash Crop.** The demand for high-quality hay in the Virginia Piedmont region has increased due to a growing horse industry and livestock producers with limited land resources who compete for a small local hay supply. The Piedmont Area Forage Field Day and Hay Showcase was conducted to teach area hay producers about high-quality hay production and marketing. Extension faculty worked with 15 local hay producers to submit 35 hay samples for forage analysis. The field day had 100 participants who learned about hay quality, viewed hay samples, and talked with local hay producers. The program resulted in the sale of 95% of the hay exhibited at the showcase, or about 60 tons of hay.

**Benefits of Extended Winter Grazing with Stockpiled Fescue.** Economists estimate beef producers experience 70% of their expenses in the cost of making and feeding hay. A traditional wintering program can be twice the cost of an extended grazing program including extensive use of stockpiled fescue. A reduction in winter-feeding expenses, while maintaining production, will improve the economic efficiency of the cow/calf sector. Virginia Cooperative Extension conducted two programs in 2005 (March and July) entitled "Graze 300" to demonstrate the benefits of extended winter grazing with stockpiled fescue. One hundred one participants learned how fellow producers have reduced their dependence on feeding hay (with as much as a $100.00 per cow reduction in cost) by increasing days on pasture. Twenty percent of participants at the July program were female who came to hear from the featured female farm manager. As a result of the "Graze 300" emphasis, a beef producer said he improved fencing to enclose additional grazing land for a group of 20 heifers that then wintered on 50 percent less hay.

**Increase Income from Log Grading and Merchandising Workshop.** Research indicates that loggers lose an average of 21 percent of the timber value harvested in southern Appalachian hardwoods due to undercut, overcut, and otherwise improperly merchandizing material in the woods. Loggers recognized a need in this area and specifically requested Virginia Cooperative Extension assistance with log bucking and merchandising. Fifty-five loggers received training in a six hour log grading and merchandising session. One-hundred percent of the learners reported an increase in knowledge regarding log grading and merchandising as a result of the program.

**Best Management for Cotton and Peanuts.** Cotton and peanuts are high value crops which have high production costs. Mismanagement and improper use of inputs creates a significant loss for producers. Virginia Cooperative Extension provided a comprehensive workshop and hands on training on the most effective production, harvest and crop protection techniques. One-hundred twenty producers attended representing 60,000 acres of cotton and 10,000 acres of peanuts. As a result of field trials demonstrations, cotton producers were able to determine which defoliation chemicals were most effective, which combinations of defoliants and boll openers tank-mixed together were most effective, the most practical rates to use, correct timing and cost effectiveness. Peanut producers were advised on stages of maturity of more popular peanut varieties and what additional fungicide applications should be considered. Cotton producers saved approximately $5 per acre, or $300,000 on 60,000 acres in selection of more economical/practical defoliates and boll openers. Peanut producers made wiser pre-harvest and harvest decisions. Producers saved $19 per acre on approximately 2,000 acres infested with spider mites by not spraying as rainfall was predicted and digging dates were within two weeks. Overall, $18,000 in application and insecticide cost was saved. Producers also harvested

increased yields of approximately five percent - 175 pounds per acres and grades increased slightly due to more accurate digging decisions.

**Growing Specialty Wheat for High Value Markets.** A large population base exists along the Atlantic seaboard of the United States. Citizens demand processed grain products such as bread and dough products. Transportation of grain is easier and cheaper than transporting flour and many grain mills and food processing facilities are located near population centers. The milling capacity exists in this region to utilize 20 million bushels of wheat per year. A large portion is imported by regional mills from wheat growing areas and approximately 30 percent is hard wheat, however some millers use only hard wheat. Hard wheat and certain strong gluten soft wheat are suitable for use in making bread and dough products. Because the market exists for bread wheat and because it is of higher value than soft wheat ($0.40 or more per bushel), growers are interested in using adapted varieties and developing agronomic techniques to grow bread wheat in the mid-Atlantic region. Virginia Cooperative Extension and Virginia Tech are evaluating management practices and cultivars that enable producers in the region to successfully adopt bread wheat production if the market is favorable.

**Improving Grain Production and Value.** With the diversity in climate and the economic importance of cultivar selection on overall farm profitability, there is an ongoing need for current information on the performance of available and experimental cultivars and lines of both small grains and corn in our environment. Virginia Cooperative Extension evaluated corn and small grain genetic lines adapted for use in 2005 and made this information available to producers. Virginia producers have excellent, unbiased information upon which to select corn hybrids and small grain cultivars. Seed companies have additional information to use to decide which corn hybrids and small grain cultivars to grow and market in Virginia. As a result improved seed genetics is offered for sale and use in Virginia and the most adapted hybrids and cultivars provide increased value from corn and small grain production by $3.00 per acre for a value of over $1.6 million annually.

**Improving Markets and Utilization of Soybeans.** Twenty thousand acres of soybeans are grown in the Shenandoah Valley. Primarily due to transportation, Shenandoah Valley farmers receive $0.40 to $0.60 per bushel less than market prices. In addition, farmers are concerned about harvest delays caused by transporting soybeans to distant markets. Virginia Cooperative Extension initiated efforts to educate local livestock producers about how to feed soybeans. As a result of educational programs portable soybean roasters were purchased in the area bringing the total number in the Shenandoah Valley to four. In 2005, four agri-businesses roasted 310,000 bushels of soybeans which is an increase of 60,000 bushels over 2001 estimates. Roasting 310,000 bushels saved farmers $124,000 in transportation costs, provided an additional $225,000 in roasting services income, and produced a valuable feed for dairy farmers.

**Managing Hulless Barley for High-Value End-Use.** Barley is an excellent rotational crop for farmers in the mid-Atlantic because it can be planted earlier than wheat and harvested at least a week earlier at similar production costs. Early harvest allows double-crop soybeans to be planted earlier which also increases soybean yields. The demand for high energy, low fiber grains by the swine and poultry industries, and availability of brewers grains for the dairy industry resulted in greatly reduced demand for local barley in recent years. Virginia Tech research has shown that

hulless barley can revitalize feed grain markets because it is more energy dense and more efficient to feed. The impact of hulless barley production in the mid-Atlantic on animal feeding industries is significant. Swine feeding trials indicate the feed value of hulless barley is similar to corn (based on gain), making it a locally grown best-cost ration additive that can save livestock producers $2/ton depending on the cost of other ingredients. Work with poultry has also shown favorable results with feed consumption and feed efficiency equal to or greater than corn. The impact for grain producers is potentially $40 per acre on 40,000 acres initially and could increase by another fifty percent as marketing efforts succeed. The potential impact of high level hulless barley production on the agricultural economy in Virginia is over two million dollars annually.

***Animal Production Efficiency***

**Effective Assisted Reproductive Technologies for Small Ruminants.** Farm biosecurity is increasing the need for assisted reproductive technologies as a means of moving preserved germplasm instead of live animals between geographically separate locations. In 2005, Virginia State University's Agricultural Research Station initiated a three-year research project "Effective Assisted Reproductive Technologies for Small Ruminants" to address improvements in estrus synchronization and artificial insemination systems for sheep and goats to facilitate this process. Three experiments were conducted in FY2005. Results from these experiments established melengestrol acetate as a viable source of progesterone for use in effective estrus synchronization schemes for hair sheep and goats. As an oral formulation, it is easily applied and may lead to an expanded use of assisted reproductive technologies in small ruminants. Three research articles were published from this research in 2005 in the *Journal of Animal Science*. Preliminary results from this research were also presented to over 200 producers at VSU-ARS agriculture and small ruminant field days in 2005.

**Regulation of Embryonic Blastocoele Formation and Development in Small Ruminants.** Understanding the communication between the embryo and uterus during early pregnancy will reduce the incidence of embryonic mortality and help Virginia producers recover approximately $1.2 million in potential income each year. In 2005, VSU-ARS addressed the embryonic mortality problem by developing a project entitled "Regulation of Embryonic Blastocoele Formation and Development in Small Ruminants." Incubation experiments were initiated and completed. Further identification and confirmation of differentially expressed genes in the developing embryo and uterus will be undertaken in 2006 and should increase our understanding of the regulation and communication during early pregnancy. A reduction in the embryonic mortality of sheep and goats in Virginia may help our producers recover approximately $1.2 million each year in profits. The information generated from these studies on the processes involved in embryo development and uterine function is needed to develop the methods to reduce embryonic mortality and boost producer profit potential. One research manuscript from this research was accepted for publication in 2006.

**Utilization of Functional Genomics to Identify Novel Approaches for Control of Internal Parasites in Goats.** Meat goat production is of the fastest growing segment of animal agriculture in the United States and is an important commodity worldwide. However, little is known about the genomics of the goat. The VSU-ARS research project funded under NRI entitled "Utilization of Functional Genomics to Identify Novel Approaches for Control of Internal Parasites in Goats"

serves to address the aforementioned issue. The primary objectives of this project are to develop collaborative efforts between goat research and other species in the area of genomics, develop capacities for goat genomics research at VSU and other cooperating 1890 Institutions, and develop preliminary sequence data on the expressed genes from goats for development of future proposals related to mapping of the genome and identification of genes involved in resistance to internal parasites. This three-year project was initiated in 2005 and is progressing extremely well. It anticipated that meaningful results will be reported in 2006.

**Development of Nutritional Strategies to Optimize Swine Productivity Under New Regulatory Conditions.** Unnecessary supplementation of vitamins in swine diets increases costs and reduces profit. Additionally, there is increasing pressure on the commercial swine industry to produce pork cost-effectively while reducing nutrient excretion into the environment and reducing the quantity of antibacterial feed additives used in swine feeds. Research results have demonstrated that the oxidized form of supplemental folic acid is the most cost-effective source to provide breeding sows while maintaining good reproductive performance. Avoiding use of the more expensive reduced forms of folic acid for vitamin supplementation can conservatively save from 2 to 4 dollars per ton in sow feed costs. On a national herd basis of 6 million sows, this could equate to 12 to 24 million dollars in annual feed cost savings. The research in this project on reducing antibiotic use in pig diets has demonstrated that certain potential replacement products are not effective and therefore cannot be justified from a cost standpoint. However, the work has also demonstrated that use of antibiotic feed additives is not essential to cost-effective feeding of young pigs. Moderate supplementation with dietary copper, particularly in organic form, can promote young pig growth performance with minimal copper excretion. Strategic supplementation of spray-dried plasma protein and improved sanitation can also yield acceptable production without antibiotic use. These practices will reduce regulatory pressure and enhance consumer confidence in the quality of pork products.

**Providing Improved Beef Genetics for Producers.** The Virginia Bull Evaluation Program is an education, management, and marketing program which serves small and modest size beef producers by providing a cooperative arrangement for proper management and competitive marketing of their genetics. The Virginia Bull Evaluation Program is the largest single source of beef genetics in the Commonwealth, enrolling 2,044 beef bulls from over 100 beef producers in Virginia and surrounding states since 2001. Marketing of 1286 bulls at auction has resulted in gross sales of $2.6 million over the past five years.

**Retaining Ownership for Increased Knowledge and Value.** The Virginia Retained Ownership Program provided beef producers with detailed economic and production information on their cattle. Enhanced understanding of genetic and management decisions that impact beef quality and consumer demands are the cornerstones of this program. Information and educational materials generated serve as benchmarks for the Virginia beef industry. In 2005, beef cattle producers participating in the program received $100 more net income per calf compared to traditional marketing.

**Assuring High Quality Heifers in Virginia.** The Virginia Premium Assured Heifer Program is an educational, management, and marketing program that was developed to provide producers with proper management of replacement beef heifers based on applications on current research in

heifer development. In 2005, beef enrolled over 2,500 heifers in this program. Marketing of 1,139 Virginia Premium Assured Heifers (VAPAH) at auction resulted in gross sales of $1,440,624. An additional 300 VAPAH heifers were sold by private treaty. Heifers developed and sold through the program averaged $1,264.81 and increased net income by almost $100 per heifer compared to non VAPAH.

**Virginia Cow-Calf Management Course and Cow Camp.** The Virginia Cow-Calf Management Course teaches beef cattle production methods and skills to beginning to mid-level beef producers. In 2005, the course became a complete distance learning program with an optional two day hands-on workshop called Virginia Tech Cow Camp. One-hundred one producers completed the Virginia Cow-Calf Management course and 88 participants attended VT Cow-Camp. The course was conducted by a team of Virginia Cooperative Extension specialists and agents. The course rated 4.5 out of 5 with producers. Producers reported the gross value of increased beef production as a result of the educational program is approximately $1.5 to $1.8 million, annually.

**Management Tools for Dairy Producers.** Shenandoah Valley's dairy industry consists primarily of family operations ranging in size from 50 to 500 cows. Sustainability and viability of the family farm is a priority issue and the use of financial records as a management tool has been neglected. The Dairy Management Institute (DMI) allowed farmers to evaluate their financial health using multiple perspectives to ensure that the business is structured and managed for competitiveness and growth. 29 farms, generating $16,321,664.00 in annual farm income participated in the DMI. Agricultural lender Farm Credit reported that DMI made their customers better managers and provided the dairy producers with customized and valuable management information. DMI participants rated the program as very strong and have asked for more detailed analysis information. One-hundred percent of the multi-year participants cited DMI as very useful in managing the dairy business operation. Thirty-six percent of the participants report increases in skills and knowledge in improved financial management.

**Sustainable Goat Production.** One hundred fifty-three persons attended this year's Meat Goat Educational Symposium. Approximately 140 were introduced to FAMACHA, a new deworming system that utilizes the pigmentation/color of the eye to determine the parasite level - thus eliminating routine worming practices. It is estimated that producers will save two worming applications annually; maintain healthier breeding herds and more efficient/faster gaining market animals as a result of adopting this new practice. Approximately $450 per herd will be saved on 70 herds (averaging 30 breeding goats per herd) netting $31,500 annual savings. It is estimated that each market animal will gain approximately five additional pounds; netting $5.00 per animal ($150 per herd x 70 herds x 2 kids annually) which amounts to $21,000 annual net gain/income as a result of more timely deworming; thus, healthier, faster gaining market animals.

***Aquaculture***

**Utilizing Fish Wastes as a Feed Supplement**. Up to 50 percent of the feed input into a commercial recirculating fish facility is excreted as fecal wastes. Disposal and potential environmental impacts can be costly. Utilization of wastes to produce a secondary crop would reduce the quantity of wastes discharged and create additional value to the production operation.

Researchers have developed a system to convert the fish waste into heterotrophic bacterial biomass that will be used to supplement the shrimp diet. As a result, shrimp feed costs, waste disposal, and environmental impacts will be reduced.

**Freshwater Shrimp Production.** Many Virginia tobacco farms have underutilized aquatic pond resources. Alternative crops that can be adopted by these farmers to supplement farm incomes need to be demonstrated. Virginia State University's Aquaculture Program helped farmers, including existing tobacco growers, diversify into freshwater shrimp production. VSU staff worked with one tobacco farmer and his Extension agriculture agent to provide guidance on pond establishment, shrimp procurement, water quality, feeding, harvesting, and marketing. Extension staff worked with the operation monitoring management practices. A shrimp culture demonstration pond was operated at VSU's aquaculture facility, and shrimp populations were displayed at agriculture fairs. To promote freshwater shrimp culture, workshops were conducted, presentations were made at professional meetings, and information sheets were distributed. Markets and distribution techniques have been identified. As a result of VSU's efforts, freshwater shrimp were successfully harvested from two commercial ponds with a surface area of approximately one acre. More than 1000 pounds of shrimp were sold fresh on ice at $7.00 per pound. Guaranteed markets have been established for most of the production. More than 10 prospective shrimp farmers are preparing for shrimp stocking next year.

**Fish Health Certification.** State and federal agencies are concerned about fish pathogens being spread from farm to farm, state to state and country to country. Many farmers are not aware of these biosecurity issues. Fish health certification will reduce the risk of fish pathogens spreading. The process for obtaining fish health certification by farmers will enable them to ship fish to other states and to markets in foreign countries. The fish health certification process and the high costs associated with it frustrate fish farmers. The most costly aspect of the fish health certification is the virology. To help expedite the process for fish farmers in the state, the Virginia State University Fish Health Specialist developed protocols for obtaining fish health certification for fish farmers from USDA-APHIS and obtaining Fish Health Certificates from VDACS Veterinary Services. The USDA-APHIS certification allows Virginia State University to perform laboratory procedures for testing selected fish pathogens such as Whirling Disease and forward the test results to the State Veterinarian for issuing the fish health certificate to fish farmers in Virginia. This would result in financial savings for fish farmers who would otherwise pay for parasitological examination and the bacteriology for a sixty-fish sample. The certification process reduces the cost by $500.00 for each farmer desiring a fish health certification to ship fish. Since the initiation of the protocols, two certifications were done for shipping trout out of state and to China. To further reduce the cost of certification for farmers, the VSU Fish Health Diagnostic Lab is considering upgrading lab capabilities for virology testing. This will reduce farmers' costs and allow for further USDA-APHIS pathogen certification. The purchase of an inverted microscope was the first step towards the upgrade.

**Recirculating Aquaculture Systems.** Farmers in Southwest and Southside Virginia have suffered economically due to the decreased demand for tobacco products, and they need opportunities to supplement their income. Production of fish in recirculating aquaculture systems has the potential to provide primary and supplemental income for these farmers. A team of Virginia Tech research and Extension faculty from the departments of Food Science and

Technology, Fisheries and Wildlife Sciences, Agricultural and Applied Economics, Biological Systems Engineering, Horticulture, Crop and Soil Environmental Sciences, and Civil and Environmental Engineering and the Virginia-Maryland Regional College of Veterinary Medicine is investigating the feasibility of producing tilapia, yellow perch, and marine shrimp in recirculating facilities; using the waste that is generated; and marketing the products that are produced. These studies are primarily conducted at the Virginia Tech Southwest Virginia Aquacultural Research and Extension Center in Saltville and at Blue Ridge Aquaculture, a commercial enterprise in Martinsville. The number of producers expressing an interest in recirculating aquaculture has significantly increased. The research is providing valuable data needed by producers to be economically successful and reduce risks.

**Local Production of Catfish Fingerlings.** One of the greatest costs associated with commercial production of catfish is the purchase of fingerlings. Commercial fish farmers normally stock ponds with catfish fingerlings that are three- to four-inches long. Several fish farmers in Virginia have experienced unacceptable death losses and poor performance when they purchased expensive fingerlings from distant states in the Deep South. Shipping small catfish long distances places too much stress on the fingerlings. The high cost of locally grown catfish fingerlings and poor performance of fingerlings shipped to Virginia from distant states is a problem that negatively impacts profitability of catfish production. Landowners who are trying to raise catfish for commercial sales in farm ponds may be able to save money and increase income by learning how to produce their own fingerlings for stocking. With the assistance of the Virginia State University Aquaculture Program, a channel catfish hatchery has been set up in rural Southside Virginia on the farm of a commercial channel catfish grower. The farmer will operate a small on-farm hatchery for the production of fingerling catfish in 2005 and in 2006. Fingerlings will be sold to local farmers throughout the Southside Virginia region. A financial analysis will be conducted so farmers can know whether such an operation is economically viable.

**Marketing Aquaculture Products.** Marketing aquaculture products has long been identified by stakeholders as a primary concern confronting present and future fish farmers. Virginia State University Extension faculty incorporated pond production economics and marketing education programs in information packages and as part of the agenda in multiple regional workshops in cooperation with agriculture Extension agents. Virginia State University provided opportunities for farmers to add value to their fish. Fish farmers are able to harvest and transport their fish to the university's fish processing facility; process their fish into fillets, and prepare/package them for sale under licensed conditions. Production now includes whole-fish (live for fee fishing and recreational pond stocking), direct pond-side sales, and processed boneless fillets for use at fund-raisers, supermarkets, and restaurants. These activities have resulted in increased incomes for existing producers, and more importantly, increased interest in aquaculture as a viable agriculture diversification.

**Hybrid Striped Bass Development.** Virginia State University was a subcontractor to a USDA Hybrid Striped Bass Development Grant (Kentucky State University lead agency). VSU's demonstration component is showing impact with production adoption in pond and in tank culture. Hybrid striped bass demonstrations, workshops, and displays were conducted to show the economic potential of the fish for agriculture diversification during 2005. Although stringent Chesapeake Bay pond-effluent guidelines exist, adoption of hybrid striped bass culture in

Virginia continues because prices received by growers remained steady and demand by recreation fishers for fee-fishing outlets increased. Live sales (tank) received $3.00 per pound with pond-side prices varying from $2.50 to $6.00 per pound for fee-fishing and upscale specialty markets. More than 70,000 pounds of fish were harvested in Virginia during 2005, with additional economic benefit resulting from hybrids serving as the major draw for fee-fishing operations. During the course of the year, hybrid striped bass were included in multiple aquaria displays. Hybrids production promotion was included in the 11-day 2005 Virginia State Fair activity and a six-day display at the Virginia Legislature. Permanent displays are maintained at the Virginia Science Museum and at Virginia State University. Sunshine bass demonstration ponds (pond fingerling, pond food-size, and cage culture) at Virginia State University were the focus of individual prospective farmer tours, multiple group visits (47), and served as one of the primary stations at the VSU Annual Aquaculture Field Day. In addition, more than 60 educational visits were made to operations at private cooperating sites. Two new producers established operations during the year. In addition, an existing operation expanded to supply hybrid fingerlings to permitted farms.

***Biobased Products and Processing***

**Omega-3 Polyunsaturated Fatty Acids from Cull Potatoes and Biodiesel Waste.** This research addresses how to utilize agricultural waste materials (cull potatoes and biodiesel waste) as raw materials to produce omega-3 polyunsaturated fatty acids. These acids have therapeutic capabilities against cardiovascular diseases, cancers, schizophrenia, and Alzheimer's. Virginia grows approximately 5,000 acres of potatoes with a total annual production of 1.2 million CWT. About 5 to 10 percent of potatoes harvested are graded as cull, all of which are disposed of through land application. This brings no added income to the growers, who must pay the cost of growing and harvesting those culls out of the marketable grades. Similarly, glycerol (approximately 70 percent pure) is a primary waste product during the biodiesel production process. The current bulk sale price is at its lowest ($0.60/lb to $1.00/lb). Clearly, the inclusion of a value-added market for these culls or glycerol would bring opportunities for additional revenue to farmers. Producing omega-3 fatty acids from cull potatoes and biodiesel derived glycerol by algae fermentation would provide such an opportunity. The omega-3 rich algae could be further developed as feed additives for certain animals such as cows, chickens, and fish to enhance the omega-3 fatty acids content of cow milk, eggs, and fish flesh. Thus, the project will benefit Virginia animal industry by enhancing the value of the final animal products.

**Bioethanol Production from Cotton Gin Residues**. Disposal of cotton gin waste is increasingly becoming a major problem in southeastern Virginia while the need for inexpensive energy sources is increasing. Researchers have developed a technology for converting cotton gin residues and recycled paper sludge to fuel ethanol using environmentally friendly methods. This process can potentially produce 90 gallons of fuel ethanol per ton of residue. Based on current Virginia cotton production figures, if cotton gin residues are converted into energy, about 1.1 million gallons of ethanol could be produced annually – the equivalent of 22.7 million barrels of oil. If ethanol is used as fuel, it will displace 21.4 million pounds of carbon dioxide annually in Virginia.

**Utilization of Processing Waste and Energy Crops for Fuel and Chemicals.** This research project investigates ways to optimize the hauling of herbaceous biomass from the production field to an on-farm storage location and subsequent hauling over-the-road to a conversion plant. Purpose is to deliver feedstock at a competitive price. The cost study provides a minimum cost (about $10/dry Mg) for hauling round bales from a satellite storage location to a conversion plant. This information provides an opportunity for policy makers to compute a "minimum" cost for biomass energy (production, harvest, and storage costs have been defined previously). To stimulate this industry, a price above this minimum must be established.

***Biotechnology***

**Impacts of Projecting the Net Benefits of Biotechnologies.** Researchers at Virginia Tech have learned that the acceptability of transgenic crops in Asia, the United States, and Virginia is influenced by the magnitude of expected economic benefits that offset expected risks. Economic benefits from transgenic crops in Asia help to reduce poverty and malnutrition in a region that contains more than half of the world's poor and malnourished. While we cannot say just how much our research reduced poverty and malnutrition in Asia, even small increases in income there can have significant impacts. For example, 82 percent of the 140 million people in Bangladesh make less than $2.00 per day; 36 percent make less than $1.00 per day. These people spend roughly 60 percent of their income on food. The projected benefits of some of the transgenic crops we studied are over a $1 billion spread over 15 years. Other expected impacts include increased knowledge by high school students, regulators, and the general public on the potential benefits and costs of biotechnology on rice and tobacco in the United States and in Asia. The research on impacts of rice biotechnologies in Asia can help U.S policymakers project market impacts of Asian adoption of rice biotechnologies and help Asia policy makers decide on their level of public support for biotechnologies. Because the benefits the researcher project for rice biotechnology are high, knowledge of these benefits may help governments to expedite the release of transgenic products that could improve the lives of millions of people.

***Diversified/Alternative Agriculture***

**Nutritional Resources for Pollen Bees and Natural Enemies.** In recent years, wild honeybee populations have been under stress. They have declined to near zero in many locations due mostly to parasite mites. Beekeepers have resorted to continuous use of pesticides for mite control. However, resistance is developing and registration of new pesticides is slowed by concern over residues. The hive beetle, a predator of bee larvae, and the eventual arrival of "killer bees" could add additional costs to beekeepers. Pollination services are likely to become more expensive in coming years. The Virginia State University Agriculture Research Station (VSU-ARS) project "Nutritional Resources for Pollen Bees and Natural Enemies" aims to address the above-mentioned problem. Preliminary results of this project were provided to over 250 farmers at VSU's Annual Agriculture Field Day in FY2002. Research in the second year (FY2003) of this project, pollen was determined for the eastern subspecies of the Blue Orchard Bee in central Virginia Results will be used to develop the eastern Blue Orchard Bee for commercial use for pollination of spring fruit crops in eastern North America. Blue orchard bees are an alternative to honey bees as a pollinator for apples, pears, cherries and other tree fruits. These bees are more efficient (40 to 100 times) pollinators than honey bees, fly in cooler

weather, and do not forage far from their nest. These bees are common throughout eastern North America but have not yet been commercially exploited. Basic information on pollen preference will help to establish sustainable management systems for this bee. Two research presentations on research results were made at the Annual Meeting of the Entomological Society of America, and preliminary results presented at three VSU's Annual Agriculture Field Day with well over 300 farmers, producers and others in attendance each year.

**Developing Alternative Vegetable Soybean Crop.** This VSU-ARS project is a follow-up project to three other projects dealing with the development of varieties of vegetable soybeans suitable to Virginia and the mid-Atlantic region. Its goal is to help farmers diversify their farm operations and to increase their profits by meeting the increased domestic and international market demand for fresh and frozen vegetables. Lack of suitable cultivars is one of the factors limiting vegetable soybean production in the United States. This project continues research for suitable cultivars in vegetable soybean. Four presentations of project research findings were made at local, state and national meetings. Two research articles were published in the *Journal of Crop Science*.

**Alternative Enterprises for Tobacco.** Virginia State University Extension faculty conducted applied research and educational programs focused on identifying alternative enterprises that former tobacco producers in Southside and Southwest Virginia could implement to replace and/or supplement the income lost from tobacco. Conferences, local meetings, field demonstrations, test marketing programs, individual consultations, and other methods were used to reach producers. Profitability of enterprises was determined through financial analysis. Budgets that describe the costs and financial returns were developed and distributed about the most promising enterprises. Specific income opportunities that were presented to former tobacco farmers include certified organic field crops, pastured poultry, pastured pork, organic beef, certified organic vegetables, early season vegetables grown in high tunnels, certified organic blackberries, fresh cut flowers, seedless watermelons, American ginseng, goldenseal, and agriculture tourism. Presenting a diverse menu of opportunities helps to avoid over-production and local competition. Over 800 farmers and landowners from Southside and Southwest Virginia who formerly depended heavily upon tobacco for income have learned about new income opportunities. Sixty farmers have established new enterprises as a result of these educational programs. Most of these enterprises have started on a small scale. Twenty-five former tobacco farmers are now producing and marketing at least one acre of seedless watermelons as a result of our field demonstrations. Net income from seedless watermelons has been $1000+ per acre when the melons are sold in local markets. Forty landowners have established naturalized populations of American ginseng and/or goldenseal in their privately owned woodlands. Fifteen former tobacco farmers have established cut flowers as a new source of supplemental income. Twenty farmers have begun raising poultry, beef cattle, or swine for selling as "natural meats" in local markets and directly to consumers.

**Evaluation of Winegrape Cultivars and Clones.** Grape cultivars and clones must be well matched to the climatic and soil properties of their production site to obtain optimal wine quality and market acceptance. The evaluation of cultivars and clones is time consuming which, given the anticipated unsuitability of some selections, is beyond the means of most industry members. This project will formally evaluate a number of grape cultivars and clones for viticulture and enological suitability under at least two geo-climatologically distinct regions of Virginia. The

multi-state nature of this project will generate a more comprehensive evaluation of existing and new Vitis germplasm than would be possible with states acting independently of each other. Knowledge of the viticulture and enological performance of new grape cultivars will specifically benefit Virginia wine producers by illustrating superior traits or limitations that would take time and considerable cost for individual producers to identify for them.

**Evaluation of Fall Broccoli Cultural Systems, Post-Harvest and Marketing of Crown-Cut Product.** Commercial vegetable production needs to remain a viable farm option for the tobacco dependent and economically depressed region of SW Virginia. Profitable crop alternatives and methods to produce them need to be developed for current and future growers. This project examines the market potential and production methods needed for successful introduction of fall-grown, large crown-cut, film-wrapped broccoli, and development of it as a new product: "Virginia Style" broccoli. Crown-cut (large17-22cm, single heads) broccoli production and marketing is emerging as a second-crop market opportunity for growers. Plasticulture results in improved yield and quality, and for fall harvest, broccoli can be sequentially planted after a summer crop, helping to recover annual investments in plasticulture. Quality is improved with Fall-grown product, though increased maturity periods should be considered for late harvests, and the risk of freeze damage, with crop loss noted below neg 3C. Market window evaluations indicate that prices improve from end of Sept., peaking in early November. Thus it is a calculated risk to target later season windows. Lower densities result in a higher percentage of desirable large heads, but less total yield by area. Effective spatial arrangement can increase plant counts, but should allow for maximum sizing. Target head size is not reached by all plants, and smaller heads can be utilized by bunching. Continued cultivar evaluation is needed for crown-cut suitability. No-till represents a sustainable means of production, however supplemental nitrogen is needed to compensate for reduced yields. Film wrapping with Modified Atmosphere Packaging (MAP) materials is a superior method of handling broccoli versus icing, resulting in increased storage time and improved quality. This method allows production of this crop without expensive icing and reduces transportation cost. In-store comparisons indicate consumer preference for film wrapped versus iced, non-wrapped broccoli. Appearance, quality, and food safety were cited as reasons.

**Increasing Irish Potato Production Efficiency.** In the spring of 2005, the state prison farm asked for help with their potato production. The farm had been growing Irish potatoes for several years, and yields had been declining every year. In fact in 2004, they barely produced more usable potatoes than the seed they had planted. The facility was using the potatoes to feed the inmates and this was unacceptable. As a result of the fertilization and weed control program work provided by Virginia Cooperative Extension and implemented by the prison farm, potato yields increased to more than six times what they were the past year. The farm increased production by 10,000 lb/A (average price of $0.10/ lb) which is a $1,000/A increase in production.

***Integrated Pest Management***

**Insect Pest Photo Guide**. A new pocket-sized insect pest photo guide helps soybean, corn, and small grains growers in the mid-Atlantic region improve Integrated Pest Management (IPM) skills. Accurate identification of insect pest and beneficial species is essential to practicing IPM.

However, proper identification of insect pests continues to challenge growers and agri-service personnel involved in pest management in field crops. An IPM survey of Virginia corn, soybean, and wheat growers found that many often misidentified insect pests. Inaccurate pest identifications often lead to unnecessary or off-label pesticide applications. Photographs of insect pests are available in numerous books, but they often include many insects not found in this region, and omit some of our major pest species. Likewise, several Internet sites with high-quality photographs exist, but results of the recent Virginia IPM survey show that a small percentage of growers are accessing these sites. In response, Cooperative Extension specialists in Virginia, Delaware, and Maryland developed a coil bound, laminated, pocket-sized guide with clear, high-resolution full-color photos of 40 insect pests and 10 beneficial insects of soybean, corn, and small grains. Insects are grouped by commodity, along with keys for easy separation of most commonly misidentified species. Ten thousand copies were produced and are being distributed across the mid-Atlantic region. A self-addressed, postage-paid postcard with three questions on usefulness of the guide was developed and distributed with each guide. Returned surveys show that ratings and comments are very positive (4.3 to 4.7 on a scale of 1=not useful to 5=very useful). We anticipate that this guide will be an effective pest management tool for many years.

**Soybean Looper and Green Stink Bug.** Two unusual pest species invaded Virginia soybean in summer 2005: soybean looper, *Pseudoplusia includens*, and green stink bug, *Acrosternum hilare*. Loopers caused partial or complete defoliation of many fields, and stink bugs fed directly on seed and caused pods to abort or shrivel. Because these were unusual pests, no local data existed to aid growers in selection of effective and economic control options. As a result, growers were applying previously untried and ineffective products to prevent potential crop loss. Two field experiments were conducted to provide guidance. Against soybean looper, pyrethroids, (Baythroid 2 at 0.05 kg ai/ha, Prolex 1.25 at 0.02 kg ai/ha, Karate 1EC at 0.03 kg ai/ha, and Karate Z at 0.03 kg ai/ha) resulted in only 49 to 63 percent control. Non-pyrethroids (Lannate LV at 0.50 kg ai/ha, Tracer 4SC at 0.05 kg ai/ha, Steward 1.25SC at 0.09 kg ai/ha, and Larvin at 0.67 kg ai/ha) provided 77 to 100 percent control. Against the green stink bug, the most effective products included Diamond 0.83EC at 0.04 kg ai/ha tank mixed with Orthene 97 at 0.54 kg ai/ha, Orthene 97 alone at 1.09 kg ai/ha, and Bidrin 8EC at 0.28 kg ai/ha. These results were provided to growers via the Virginia Ag Pest Advisory and posted on the website: http://www.sripmc.org/virginia. Informal interviews suggested that these data influenced most local agricultural product suppliers to shift their inventories to include these more effective products and as a result, at-risk fields were protected.

**Resistance Management and Benefits of Neonicotinoid Insecticides on Potatoes.** Potatoes are a $20 million industry in Virginia, and are attacked by several insect pests which reduce yields and marketability. Among these insect pests are Colorado potato beetle (CPB), potato leafhopper, and wireworms. Historically, Colorado potato beetle has developed resistance to virtually every insecticide used against it. In 1996, neonicotinoid insecticides were registered for use on potatoes, and greater than 90 percent of Virginia growers have used them every year since for insect control. Yearly monitoring of neonicotinoid toxicity levels of potato beetle populations has shown that resistance levels in Virginia CPB populations are relatively low, which has enabled growers in the state to continue to use these chemicals effectively. Research has also shown that seed-piece treatments of neonicotinoids work as well as soil drenches, but at only a

fraction of the field application rate. Further studies have also shown that neonicotinoids provide season-long control of other pests such as potato leafhopper and wireworms in the soil comparable to those of organophosphate standards, thus reducing the need for these highly toxic chemicals. Additional research has identified many new IPM-friendly insecticides such as novaluran, indoxacarb, and metaflumizone, as well as various experimental compounds that have been found to be efficacious against CPB, and will be excellent control alternatives that can be rotated into a neonicotinoid resistance management spray program for potatoes in the future.

**Enhanced Biocontrol of Insect Pests in Limited Resource Greenhouses**. Greenhouse production of vegetables provides an alternative source of income to small and limited resource farmers during the colder months. Insect pest control is a major problem. Many pest species are common to those found in heavily sprayed ornamental greenhouses and are now resistant to few insecticides labeled for greenhouse vegetable use. Biological control with natural enemies is sometimes the only effective control available. An added benefit of biocontrol is that this form of pest control fits the "organic" label that now has USDA certification standards. The VSU-ARS project "Enhanced Biocontrol of Insect Pests in Limited Resource Greenhouses" aims to address greenhouse insect pest control issues by using biological controls. Three commercial greenhouse operations in Virginia and North Carolina are participating in this project. Pest monitoring reduced the cost of the initial use of nematodes and shows promise for thrips control. Major problems encountered in the biological control greenhouse were fungus gnats and thrips. FY2003 experiments of releasing of natural enemies, mites in sachet bags, in advance of spring thrips adult invasion into three commercial greenhouses reduced thrips populations and prevented and/or delayed development of spotted wet virus in tomatoes. Results of this research were presented to greenhouse growers at local, state and regional meetings/field days, and at the national Annual Meeting of the Entomological Society of America. These studies were continued in 2004 and completed in 2005. Overall this research found that more effective pest control could be obtained by identifying those natural enemies that were and were not effective in tomato greenhouses in the mid-Atlanta region. Over the three-year life of this project, four research publications were published in referred journals; five research presentations were made at professional meetings; six presentations were made at VSU-ARS agricultural field days; and best practice materials were developed and distributed to greenhouse growers by Extension agents.

**Novel Strategies for Potato Insect Pest Management in Virginia.** Insect pests remain important limiting factors to potato production in Virginia. A number of currently-used insecticides may lose registration on potato. This project examines several new strategies for managing the primary insect pests of potato including Colorado potato beetle, wireworms, European corn borer, and potato leafhopper. Potatoes remain an important crop in Virginia with production on nearly 2,500 hectares annually. Because neonicotinoid insecticides remain efficacious against Colorado potato beetle in the state, growers can continue to use this effective and relatively environmentally-friendly means for insect control in potatoes and other solanaceous crops. Concomitantly, growers do not need to apply foliar insecticides to protect their crops, thus resulting in less pesticide exposure to workers and the environment. Also, because these insecticides provide some control of wireworms, applications of toxic organophosphates to the soil can be reduced or even eliminated. Even greater reductions of

insecticide use may be possible by using semiochemical attractants of CPB that can draw beetles to a point source for control, and thus reduce the amount of insecticide needed.

***Invasive species***

**Invasive Aquatic Weeds.** Mild winter temperatures in Virginia have resulted in the establishment of hydrilla, duckweed, chara, and other invasive aquatic weeds in some water bodies. Educational programs have been conducted by Virginia State University to prevent the further spread of these plants. Certification workshops for aquatic environment chemical use and educational programs that include plant identification training and the promotion of environmentally sound integrated control methods have been conducted. The workshops emphasize biological control of the invasive plant species using aquaculturally produced triploid grass carp. Homeowner groups with aquatic weed infested impoundments have increased their purchases of grass carp. Minimizing shoreline pondweeds decreases available breeding areas for mosquitoes that are associated with human health concerns such as West Nile Virus.

**Impact of Weed Management Strategies on Nursery Crop Growth, Development, and Maintenance.** In a 2002 industry survey, gross receipts for the Virginia nursery, greenhouse, and landscape industries totaled $1.14 billion dollars. Weed control is an important concern in nursery production and landscape maintenance. This project evaluates nursery crop tolerance and efficacy for non-chemical and chemical weed management strategies. Herbicide application method affected azalea growth. Stunting of plant height occurred only when the shoot system was exposed. By applying pendimethalin to only the growing medium, no reduction in azalea height occurred. Apparently pendimethalin can be absorbed by azalea shoots following overtop application. This chemical can also suppress root development when the root system is exposed. Container producers can minimize potential for reduced shoot growth through soil-only applications, thus producing a salable plant in a shorter period of time.

**Volunteers Trained to Control Invasive Plants.** Invasive plants are impacting trees and natural areas in Arlington by degrading tree health and reducing native plant diversity. The Department of Parks, Recreation and Community Resources needs trained volunteers and community support to implement invasive plant control efforts in county parks. Fifty-nine educational programs related to invasive plants, control techniques, and native plant identification were conducted. Volunteers were trained to recognize invasive plants and in safe control techniques. Volunteers participated in 38 community volunteer workdays. Volunteers could recognize and identify 30 percent more invasive plants after training. Volunteer groups and individual volunteers worked on invasive plant control at 29 different county property sites. Thirty-one local organizations and neighborhood groups assisted with invasive plant control efforts. Volunteers contributed 1,632 hours (1,332 on control work and 300 on educational programs, monitoring, and administrative tasks) to the Arlington Invasive Plant Program. Volunteer hours exceeded the county's goal of 1,280 hours by 452 hours (35 percent).

***Manure and Nutrient Management***

**Developing Alternatives for Managing Poultry Litter**. Due to water quality regulations, the poultry industry was seeking alternatives to manage the estimated 350,000 tons of poultry litter

generated annually in the Shenandoah Valley of Virginia. One solution was to increase the transport of poultry litter to nearby non-poultry producing areas where it could be used as a fertilizer. Numerous discussions were held with farmers, poultry industry representatives, and litter brokers. One idea that emerged was to locate pull-type litter spreaders in counties targeted to receive litter. As a result, the poultry industry fully funded the purchase of three pull-type spreaders. To date, 5,903 tons of litter have been spread with this equipment with an average cost of $2.58 per ton. In contrast, the state cost-share program moved 6,537 tons of litter with an average cost of $4.89 per ton. These three pull-type spreaders will likely apply 15,000 tons of litter over five years. In addition, Extension personnel educated farmers about the use of poultry litter as a fertilizer through news articles, research on using poultry litter to fertilize small grain, meetings, and by maintaining a list of people who are in the business of transporting and/or spreading poultry litter. Data from the Virginia Department of Environmental Quality indicate that in 2004 about 120,000 tons of poultry litter was transferred out of the poultry-producing region. This is an increase of about 50,000 tons over 2001 estimates.

**Advanced Animal Waste Management in the Shenandoah Valley.** The Shenandoah Valley of Virginia produces about 25 percent of the Commonwealth's poultry. The industry is under increasing pressure because the traditional methods for waste management are no longer suitable for the region because of excess nutrient in the soil. New and innovative waste management methods are required for this area. Extension agents have initiated research to convert poultry litter into pyrodiesel, slow-release fertilizer, and producer gas. The pyrodiesel will be used as fuel for heating poultry houses, while the nutrients in the litter are captured in the char and released at a rate ten times slower than the original litter nutrient when applied to the soil. Researchers have demonstrated the technology in the laboratory and agents have now applied for funding to build a demonstration unit. This technology will not only solve the nutrient problem, but will also provide an inexpensive renewable energy source for the growers, especially important in light of current high crude oil prices. This project will create new jobs in the Valley, increase poultry production, and improve both water and air quality. When completed, the technology will be able to remove over five million pounds of N and P annually.

**Biosolids' Auxin Activity and Drought Resistance.** The United States Environmental Protection Agency (EPA) estimates that approximately 7 million tons of biosolids are generated annually by the 16,000 wastewater treatment facilities in the United States. Only about 60 percent of these treated biosolids are beneficially used as fertilizer on farmland. Biosolids provide land managers with $60.00 to $160.00 worth of fertilizer per acre. It is well documented that the addition of organic materials to the soil enhances the biological, physical, and chemical properties of the soil. However, published empirical evidence appears to support the argument that biosolids provide yield advantages beyond nutrient supply; the exact nature and value of these benefits have not been described or quantified. Our biosolids research has focused on identifying and determining the mode of action of constituents other than essential plant elements that may contribute to the growth and yield enhancement benefits observed with biosolids in order to make better use of this recycled product of wastewater treatment. Researchers have found that biosolids contain biologically active amounts of the plant growth hormone auxin and auxin-like compounds. In drought studies where mineral nutrition and soil moisture availability were equalized across treatments, tall fescue grown in biosolids-amended soils displayed improved drought resistance. Ongoing research has the objective of documenting

a closer relationship between biosolids' auxin activity with that of improved drought resistance.

**Developing Systems to Produce "Designer Wastes" on Virginia Dairy Farms.** Application of excess manure nutrients to environmentally sensitive land areas results in pollution of air and water resources. The major focus of this research program is to reduce this pollution by reducing the phosphorus content of land-applied manure. Research approaches being used are: (1) identifying ways to increase the availability of dietary phosphorus to reduce its excretion; (2) improving understanding of bone metabolism in order to define dietary phosphorus needs of the cow at different ages and stages of lactation; and (3) applying mechanical and biological waste treatment techniques to dairy manure to remove phosphorus from land-applied waste. Researchers in the Departments of Dairy Science and Civil and Environmental Engineering have a major collaborative project applying mechanical and biological waste treatment techniques to reduce phosphorus content of land-applied manure. They have characterized the composition of separated dairy manure, and evaluated the effect of diet on this composition, with the goal of designing and evaluating wastewater treatment systems to achieve a target nutrient composition. They have successfully designed and are operating manure treatment reactors removing more than 90 percent of the phosphorus from dairy manure. Land-application of these "designer wastes" will more precisely meet phosphorus and nitrogen needs of crops, reducing phosphorus losses from farms while minimizing the need to purchase supplemental fertilizer nutrients.

**Fertilizer Recommendations for Environmental and Economic Benefit.** Non-point source pollution continues to threaten the Chesapeake Bay and its tributaries. Farmers are encouraged to take soil samples and utilize the pre-side dress nitrate test when using organic sources of nitrogen. Six-hundred twenty-two soil samples were tested by the Virginia Tech Soil Testing Lab from Essex County in 2005 and 20 Pre-Side dress Nitrate Tests were conducted for corn producers with over 1,000 acres of corn. Recommendations were resulted in less nutrient loading on the environment and significant savings to the farmer. Nutrient management recommendations were made for 2,000 acres of corn and 2,000 acres of small grain. In soils testing high for phosphate, no additional phosphate was applied. The prescription management recommendations resulted in a reduction of fertilizer costs by over $10 per acre compared to industry standards and less nutrient loadings on the environment.

***Niche Markets***

**Commercial Production of Fresh Cut Flowers.** The primary emphasis of Virginia Cooperative Extension agriculture programs at Virginia State University is development of new enterprises that landowners may use to increase the profitability of their farming operations. One enterprise that is especially promising for small-scale and limited-resource farmers is production of fresh cut flowers. A commercial operation can be established on less than three acres of land using family labor for planting and harvesting the crops. Virginia currently has a large established cut flower industry, but it is primarily a marketing industry. Wholesale and retail florists throughout the state sell several million dollars of cut flowers each year that they buy from growers in California, Central America, and Holland. There are only five large commercial cut flower operations in Virginia. These few growers produce less than one percent of the volume of product that is sold. These are high value crops. Typical wholesale prices paid for bunches of cut flowers are $2.00 to $8.00 for ten stems depending upon the species and season of the year. To

build a successful cut flower operation, beginning growers need to acquire skills in production, marketing, and business management. Virginia State University conducts an annual Virginia Cut Flower Growers Conference, an annual Cut Flower Growers Field Day and field demonstrations at VSU's Randolph Farm and on several private farms. Educational presentations about commercial production of cut flowers were made at local meetings across Virginia. Individual consultation was provided by phone, mail, and farm visits to support beginning growers. Over 120 Virginia landowners have established cut flowers on a small, careful scale of ¼ acre to one acre of production. These growers earned average net income of $8,000 from marketing fresh cut flowers. They are encouraged to begin marketing directly to consumers at farmers' markets and directly to retail florist shops and restaurants. Twelve growers have become large enough to make volume deliveries to one of several wholesale florists in the state.

**Small Farm Outreach.** Virginia State University's Small Farm Outreach Program implemented a community outreach and risk management education program in 24 Central and Southeast Virginia counties. Through this program, agriculture producers and beginning farmers received information and hands-on training, and participated in various educational programs intended to promote farm profitability and sustainability. Educational programs were designed to increase the ability of producers in managing on-farm risks to include: production risks, marketing risks, financial risks, legal risks, and human resource risks. As part of the program, approximately 90 producers participated in a two-day Direct Marketing Farm Bus Tour to Virginia, North Carolina, and Maryland. Participants were able to see first-hand successful small-scale farm operations that use various direct marketing techniques such as roadside stands, pick-your-own establishments, value-added products, and pre-paid produce subscription service (better known as community-supported agriculture). Approximately 60 percent of those who participated indicated that they would utilize some direct marketing strategies learned on the tour to increase their farm profits.

**Improving Small Family Orchards.** Individual fruit growers are re-establishing family orchards. Most are requesting varieties that are referred to as "antique" and are not available from commercial nurseries. As a result of three Virginia Cooperative Extension grafting classes, 65 fruit tree producers grafted 800 apple/pear trees. Considering a 70 percent survival rate, the trees have a value of $11,200.00. In addition, one producer is now growing and selling year old trees as a supplemental source of income while another established an 8 acre orchard and sells $5,000.00 of fruit annually.

**An Alternative Vegetable Crop-Fall Broccoli.** Virginia producers need high value crops which can return net profits on small acreage. In 2004-05 experiments were conducted at Kentland Farm and on grower sites to characterize the production and marketing for fall-grown, crown-cut, and film wrapped broccoli as a supplemental crop for Virginia growers. Field studies compared yields in conventional, plasticulture and no-till systems, and density arrangements on plastic. Plasticulture performed well, though promise exists with sustainable no-till systems. Double row configuration and 12,000 plants/acre was optimum. Variety trials identified outstanding early and late varieties adaptable to this region and production on plastic. Consumer preferences were also tested for this product. By a 2:1 margin wrapped crowns were preferred to unwrapped crowns. In 2004, sample shipments were provided to wholesale buyers, who expressed interest in the product and requested more test product for 2005. In 2005, two growers

planted four acres of two cultivars in Southwest Virginia. Three-hundred thirty boxes of commercial product were delivered to the Food City Grocery Chain for evaluation and sales. During 2004-2005, faculty and students initiated market window and budget analysis. Projections for peak windows using USDA historical data confirmed opportunity for fall-season markets from early September through early November. Prices improved toward the end of this period, though frost risk also increased. Budget analysis indicated the importance of cost reduction, and the practicality of re-utilizing plasticulture inputs for a second crop.

***Plant Disease Management***

**Phytophthora Disease Mitigation through Pump and Inlet Placement in Recycling Irrigation Systems.** Phytophthora inoculum in irrigation water has been an emerging problem in nurseries and greenhouse industries in the United States. The direct losses due to Phytophthora in horticultural crops are estimated as billions of dollars. Phytophthora disease management is dominated by chemicals, accounting for more than 25 percent of the total fungicide dollars spent on this disease. Reports of the development of fungicide resistant strains of Phytophthora have been increasing. Some fungicides used against Phytophthora are classified as carcinogenic by the EPA. Horticultural industries have been increasingly dependent on recycled water for irrigation. Recommendations made to growers to implement water recycling systems have increased the levels of Phytophthora inoculum in irrigation systems. This places many nursery and greenhouse crops at ever greater risk of Phytophthora diseases. Chlorine, a commonly used water decontamination agent, has been less popular in use because of its association in human health hazard and phytotoxicity. Other available methods are of limited capacity and/or limited use in the nursery and glasshouse crops. Research on the aquatic ecology of Phytophthora species has shown a decline in populations with increasing distance from a runoff entrance. Also species diversity was differed with the depth. This research is proposed to study vertical and horizontal distribution of Phytophthora species in the WRB located in different plant hardiness zones of Virginia, Maryland, and Pennsylvania, and devise an ecologically based disease management approach.

**Asian Soybean Rust.** Asian Soybean Rust is a disease that will eventually reach the soybean fields of Virginia. Producers often feel the need to make preventive fungicide applications to soybean fields at certain growth stages to protect the plant and to improve plant health without scouting to see if a real need exists. In 2004 and 2005, more than 12 on-farm replicated plots were examined with producer cooperation to determine if this application practice gave any significant yield advantage. In 2004, at eight locations, the average yield advantage was 2.8 bushels/acre. The cost of the application is approximately $18.00 per acre. At $6.00/bushel beans, this is not even a break-even proposition. In 2005, at five locations, results were similar. An average-sized soybean producer with 500 acres of soybeans who used this method would spend $9,000 in pesticides with only a break-even return. Scouting and making applications only when there is a need would save this farmer $9,000 and reduce the amount of pesticides sprayed into the environment by 31 gallons.

**Evaluation of Maize Germplasm, Hybrids, and Inbreds for Resistance to Gray Leaf Spot Disease, Under No-tillage Production.** Gray leaf spot of corn, caused by the fungus Cercospora zeae-maydis, is disease of world-wide significance. The pathogen survives from season to season

in infested corn residues. The widespread use of no-tillage or reduced tillage practices have favored this disease. The purpose of this project is to evaluate gray leaf spot resistance in commercially available hybrids, inbred, experimental hybrids, and maize germplasm. The long term goal is to provide germplasm that can be used to provide higher levels of resistance in hybrids for the Nation's corn growers. The acceptance and use of hybrids identified by this project as less susceptible have saved Virginia corn farmers nearly $15 million per year from grain losses due to GLS on approximately 121,000 ha.

**Improving Disease Control and the Profitability of Peanuts in Virginia.** Peanut production in Virginia has a history of heavier disease losses in comparison to other states. Tomato spotted wilt virus (TSWV), Cylindrocladium black rot (CBR), northern root-knot nematode, leaf spot diseases, and Sclerotinia blight severely limit the profitability of peanut production in Virginia. While fungicides and soil fumigants are available for effective control of these diseases, their usage is limited by cost and the current low market value of peanuts. The deployment of cultivars with disease resistance will reduce the dependence on chemicals for disease control and has the greatest potential for restoring the profitability of peanut production in Virginia. Transgenic cultivars of Virginia-type peanut with superior disease resistance broaden the scope of possibilities for effective disease management. Through the use of genes already present in food crops (i.e. the barley oxalate oxidase gene), it is expected that previous opposition to use of this technology may be minimized. Continuation and refinement of weather-based advisories for control of foliar diseases and Sclerotinia blight have enabled early detection of disease and improved the efficiency of fungicide sprays. Transgenic peanut lines with the oxalate oxidase gene have the potential to eliminate the need for fungicide sprays which cost growers $188/ha to $282/ha for the two or three applications often required for control of Sclerotinia blight.

**Multidisciplinary Evaluation of New Apple Cultivars.** With the push toward planting new apple varieties, some of these may be more disease susceptible and require more fungicides for management or they may be more resistant and help to reduce pesticide use. Disease susceptibility assessment under differing disease pressures provides a baseline for expected performance in a typical year in the region, and helps growers make sound decisions in Virginia and the region, leading to a potential reduction in fungicide usage. This project evaluates the disease susceptibility and resistance and horticultural qualities of new apple cultivars. Diseases are important limiting factors for production of apples in different regions of the USA. Disease susceptibility assessment in successive years provides a baseline for expected performance in a typical year in the mid-Atlantic region and contributes to a solid database for the geographical area covered by this project. Advanced knowledge provided by this project about disease susceptibility and resistance of new cultivars helps to guide planting and disease management decisions in Virginia and the region, leading to a potential reduction in fungicide usage. Disease resistance is a particularly useful consideration in certified organic fruit production.

**Controlling Target Leaf Spot for Virginia's Tobacco Farmers.** Target leaf spot is a foliar disease of tobacco that costs Virginia growers between $6,341,000 and 19,023,300 in 2004. No effective control methods have been available, until 2004 research identified a fungicide (Quadris) that controlled the disease. The 2004 research results provided the data needed in 2005 to request an emergency exemption from the Virginia Department of Agriculture and Consumer Services and from Environmental Protection Agency which allowed Virginia's tobacco farmers

to use the fungicide to control target leaf spot in the 2005 growing season. As a result Virginia tobacco producers received an average net benefit of $129 to $555 per acre, depending upon the severity of disease pressure. Based upon 2004 results, temporary registration of Quadris for target spot control could have saved an average Virginia tobacco farmer facing severe disease pressure between $15,866 and $21,566.

**Virginia Peanut/Cotton InfoNet Enhances Crop and Disease Management.** The Peanut/Cotton InfoNet (www.ipm.vt.edu/infonet) and Peanut Hotline provided county Extension agents and growers with timely information for the management of peanut and cotton in Southeastern Virginia in 2005. Included were advisories for control of early leaf spot and Sclerotinia blight of peanut, soil temperatures for timely planting of cotton and peanut, heat unit reports for growth and maturation of cotton and peanut, and frost advisories during peanut harvest. Collectively, the recommendations provided producers with information needed to make wise management decisions from planting to harvest of crops. For example, as a result peanuts harvested without freeze damage had an average value of $425/ton in 2005 whereas frost damage would have resulted in a value as low as $100/ton. The program warned producers and provided advice on daily threats. The Peanut/Cotton InfoNet and Peanut Hotlines were accessed 2507 times in 2005 by 154 producers.

**Growing Bell Peppers in Phytophthora Infected Soils.** Two years ago, growers in Scott County lost 40 to 60 percent of their bell pepper plants to Phytophthora capsici. Apparently the plant disease was in the Clinch River and transferred to the field through irrigation water. Without a simple way to get rid of the disease once fields are infected a system was needed to enable growers to continue to raise bell peppers and prevent the disease. A system was developed which began with Methyl Bromide fumigation of the raised beds and the use of Phytophthora tolerant varieties. It also included cultural practices such as proper watering and fertilization. Systemic fungicides were injected through drip irrigation systems, while foliar fungicide combinations were also utilized. This system allowed producers to grow bell peppers in Phytophthora infected fields. Yields increased from 500 bushels/acre prior to implementing the system to 1,500 bushels/acre after implementation. Growers were able to secure a lucrative contract to a local chain store that purchased their peppers at prices significantly higher than the open market. This system increased gross sales by $8,000 to $10,000/A.

**Variety Resistance to Emerging Diseases and New Races.** Diseases of wheat and barley frequently result in annual yield losses ranging from 10 to 20 percent. Often two or more fungicide applications are required to control disease in susceptible varieties. If resistant varieties were not available, Virginia producers would apply fungicides over an area of 200,000 acres. At $12.00 per acre, this fungicide treatment would cost these producers $2.4 million. Since 1991, Fusarium head blight (scab), has emerged as a disease of major importance. In 1998 this disease reached epidemic proportions in Virginia and resulted in a loss of over 92,600 metric tons of wheat with a value of nearly $9 million. Scab epidemics in 2003 were more severe and widespread than in 1998. In addition to the yield losses caused by this disease, there is significant concern about food safety as the causal pathogen produces a toxin that renders the grain unsafe for consumption by humans and animals. Highly effective fungicides are not available for scab; therefore, resistant varieties currently provide the best line of defense. Virginia Tech wheat varieties Roane, McCormick, and Tribute have moderate resistance to scab. In 2005, stripe rust

emerged as a new disease in Virginia and severe epidemics resulted in significant yield losses. Wheat varieties McCormick, 3706, Featherstone 176, and Dominion have moderate to high levels of stripe rust resistance.

**Plant Disease Diagnosis.** The Plant Disease Clinic keeps annual records of plant diseases diagnosed in the Commonwealth of Virginia. These records represent valuable historical data on pre-existing and introduced pathogens. Such data has acquired increased significance in the post-9/11 era with the potential threat of agricultural bioterrorism. Although diagnosis of most plant samples submitted by Virginia Extension agents is performed at the Plant Disease Clinic in Blacksburg, some diagnosis, including diagnosis for certain important crops, is done at the Agricultural Research and Extension Centers (ARECs). In the past, electronic records of diagnoses performed at the ARECs were not kept. We were able to equip three of the ARECs with the "PClinic for the Web" database in 2005 and have trained personnel at two ARECs in the use of this database in 2005. As a result, Virginia has a more complete picture of the diseases occurring in the state and more complete records will be submitted to the National Plant Diagnostic Network (NPDN) each year, starting in 2006. As a result, regulatory officials, producers, and scientists are better equipped to prevent crop losses.

## Funding and FTE's

Extension Funding

| Year | Federal | State | Local | Other |
|---|---|---|---|---|
| 2000 | $3,139,906 | $8,773,279 | $1,575,233 | $1,332,276 |
| 2001 | $3,234,103 | $9,036,477 | $1,622,490 | $1,372,244 |
| 2002 | $3,331,126 | $9,307,571 | $1,671,165 | $1,413,411 |
| 2003 | $3,431,060 | $9,586,798 | $1,721,300 | $1,455,813 |
| 2004 | $3,533,992 | $9,874,402 | $1,772,939 | $1,499,487 |
| 2005 | $3,640,012 | $10,170,634 | $1,826,127 | $1,544,472 |

Research Funding

| Year | Federal | State | Local | Other |
|---|---|---|---|---|
| 2000 | $11,554,000 | $18,662,000 | $0 | $6,784,000 |
| 2001 | $11,856,000 | $19,214,000 | $0 | $6,988,000 |
| 2002 | $12,167,000 | $19,783,000 | $0 | $7,198,000 |
| 2003 | $12,488,000 | $20,368,000 | $0 | $7,413,000 |
| 2004 | $12,819,000 | $20,970,000 | $0 | $7,635,000 |
| 2005 | $13,158,704 | $21,588,615 | $0 | $7,860,233 |

Extension FTE's

| Year | Professional | | | Paraprofessional | | |
|---|---|---|---|---|---|---|
| | 1862 | 1890 | Other | 1862 | 1890 | Other |
| 2000 | 125.9 | 6.8 | 0.0 | 0.4 | 16.0 | 0.0 |
| 2001 | 114.1 | 4.7 | 0.0 | 0.4 | 16.0 | 0.0 |
| 2002 | 88.2 | 3.0 | 0.0 | 0.4 | 16.0 | 0.0 |
| 2003 | 90.4 | 1.8 | 0.0 | 0.4 | 16.0 | 0.0 |
| 2004 | 125.9 | 6.8 | 0.0 | 0.4 | 16.0 | 0.0 |
| 2005 | 125.6 | 6.8 | 0.0 | 0.0 | 16.0 | 0.0 |

Research SY's Only

| Year | 1862 | 1890 | Other |
|---|---|---|---|
| 2000 | 98.6 | 7.43 | 0.0 |
| 2001 | 99.6 | 7.43 | 0.0 |
| 2002 | 100.6 | 7.43 | 0.0 |
| 2003 | 101.6 | 7.43 | 0.0 |
| 2004 | 102.6 | 7.43 | 0.0 |
| 2005 | 103.6 | 7.43 | 0.0 |

## Goal 2: To provide a safe and secure food and fiber system

The prevention of food borne illness is a major responsibility of food producers, processors, distributors, retailers and regulatory agencies. Virginia Tech faculty played a major role in developing internationally adopted principles and conducting training programs for producing safe food products. Microorganisms are of significance in food systems because they have both adverse and beneficial effects. They can cause spoilage and illness, but they are also used to produce a variety of foods through fermentation.

At Virginia Tech, work included food microbiology research concerned with food borne pathogens, microbiological spoilage, prevention and control of contamination during processing, thermal and non-thermal processing, and method development to detect microorganisms and their toxins. Recently, food safety research has focused on control of major food borne pathogens in primary agriculture production and processing through the application of new and traditional processing technologies, antimicrobials, sanitation, and Hazard Analysis and Critical Control Point (HAACP) based strategies and analytical methodology. Researchers and specialists help processors identify sources of contamination and develop strategies to prevent future problems. Animal and food scientists work with raw animal and plant products and processed foods and beverages at various levels of production.

Animal diseases impact food supplies, trade and commerce, and human health and well being in every part of the world. The risk of foreign animal and emerging diseases has increased in recent years. Examples include bovine spongioform encephalopathy, monkey pox, avian influenza, and

Escherichia coli O157-H7. Outbreaks can cause economic and health effects and also may threaten food security, shake confidence in the food supply, and influence long-term consumer eating habits.

Food safety and security is addressed by Extension through workshops with agents, farmers, producers, processors, distributors, retailers, and consumers. The events leading up to and the establishment of a national animal identification system led Virginia Cooperative Extension to establish priority educational programming to safeguard animal health. As a result of the program, 3,000 Virginia animal premises have been voluntarily registered in the National Animal Identification System. Once fully implemented, the program will allow a 48 hour trace back to allow animal health officials to identify and contain food animal disease incidents.

The Virginia-Maryland College of Veterinary Medicine has research, teaching and Extension programs that ensure that animals entering the food supply are free of disease. The animals may still harbor organisms that are pathogenic to humans including Salmonellae, Cryptosporidium, E. coli O157:H7 and others. Ongoing programs develop better detection systems and ways to treat animals harboring pathogens. Our undergraduate and graduate students are taught the principles of food safety in most classes including: food microbiology, food processing, advances in food microbiology, dairy processing, quality assurance, poultry processing, veterinary toxicology, and many others.

Food Science and Technology examines food safety issues during processing and develops intervention systems. This department has an active Extension program to train processors, distributors, federal, state and local government inspectors, and others. Collaboration projects with the departments of Food Science and Technology, Horticulture, Dairy Science, and Veterinary Medicine are training Extension agents to play an important role in farm food safety. These integrated research, Extension and teaching projects promote HACCP, Safe Quality Food (SQF) and Good Agricultural Practices (GAPs).

Virginia Cooperative Extension and the Department of Human Nutrition, Foods, and Exercise Science works with consumers to promote food safety. The Expanded Food Nutrition Education Program and Smart Choices Nutrition Education Program assistants train limited resource families about the principles of safe food handling and processing. The Department of Hospitality and Tourism works with all aspects of the food service industry to enhance food safety.

Food safety and security are issues that affect everyone and must be effectively addressed from the farm to the table. The target audiences include students, producers, processors, distributors, Extension agents, retailers, consumers and state and federal food inspectors. In addition, Extension personnel work directly with additional clientele groups on food issues.

Research and Extension outputs generated as part of this goal included: 10 refereed journal articles, five books and book chapters, seven numbered Extension publications, seven theses and dissertations, and four other reports.

This section highlights the 2005 accomplishments of Virginia Tech and Virginia State University in assuring that our state has a safe and secure food and fiber system. Seven theme areas are included in Goal 2:

- Food Accessibility and Affordability
- Food Handling
- Food Quality
- Food Safety
- Food borne Illness
- Food borne Pathogen Protection
- Food Security

## *Key Themes*

### *Food Accessibility and Affordability*

**Fresh Quality Produce: The Arlington Farmers Market.** Virginia Cooperative Extension organized producers from Northern and Central Virginia to provide a weekly supply of fresh produce and specialty foods in Arlington, Virginia. In 2005, market producers increased sales, vendors, and customers as a result of Extension efforts including weekly newsletters that provided 950 customers with regular market updates. Extension efforts with producers resulted in increased visibility through strategic market promotion at movie theatres near the market, on a market website, and in ads placed in a calendar of farms available in the Washington, D.C. metro area.

**Improving Youth Nutrition**. A total of 9,938 youth participated in a minimum of six nutrition education lessons. As a result, 77 percent of 709 youth surveyed report they now eat a variety of foods, 74 percent increased their knowledge of the essentials of human nutrition, and 64 percent increased their ability to select low-cost, nutritious foods.

### *Food Handling and Quality*

**Understanding and Enhancing Milk Quality**. Dairy processors are currently using the preliminary incubation count or the P.I. test on trailer loads of milk they receive. When these counts are high, milk-marketing cooperatives may not be allowed to send these loads to certain plants. Re-routing is time consuming and expensive, and this milk is discounted for quality reasons. Local cooperatives have begun to assess penalties to overcome this added expense. Producers ask questions: Why and how is this test run? What causes high counts? What can we do to lower or prevent high counts? In addition, producers are faced with a proposed decrease in the maximum somatic cell count for saleable milk. The proposed discount and the penalties for high P.I. counts caused producers to pay more attention to milk quality and its impact on their bottom line. Two milk quality educational meetings were held. One hundred eight-three producers and industry representatives attended a meeting addressing milk quality and what top producers do to maintain milk quality and production. As a result, producers surveyed stated they were made aware of practices that would help to reduce somatic cell counts and once implemented, the premium paid for quality milk would be cost effective. A second educational

program provided 83 dairy producers with tools to address P.I. counts. Producers indicated an increased understanding of how and why the tests are necessary and what they can do to prevent or lower high P.I. counts.

**Quality in Dairy Processing.** The Food Science Department provided technical and educational support to eight major processing dairies in Virginia including two new state-of-the-art aseptic facilities which resulted in improvements in the quality control and production of extended shelf-life refrigerated and shelf-stable fluid dairy products.

**Dairy Product Shelf Life**. Dairy products are readily susceptible to light-induced oxidation. Consumer preference influences the use of clear packaging materials for fluid milk; however, photo-oxidation can cause nutritional and flavor deterioration to occur in products packaged in materials that do not block light or control the oxidation process. Novel packaging materials, such as iridescent films, have the potential to block specific light wavelengths while still retaining a translucent characteristic. Iridescent films with 40 percent light block were ineffective in reducing the production of off-odors and flavors in milk. Food Science and Technology researchers and chemists, working with chemists from the Department of Chemistry, are developing avenues of controlled release of antioxidants to enhance food quality and extend shelf life of dairy products.

**Controlling Mold on Cheese.** Until recently, cheese sales in the United States were blocks of cheese that were protected from mold spoilage by vacuum packaging. Consumer demand for more convenient forms of cheese have led to the sale of various forms including shredded, cubed, sliced, and crumbled. These forms of cheese now account for over 24 percent of the 8.87 billion pounds of cheese produced in the United States (2004 data). These convenient forms cannot be vacuum packaged and are susceptible to mold spoilage. Most processors have tried to control mold spoilage on cheese with the natural ingredient Natamycin. Natamycin is an antifungal agent employed by the dairy industry to prevent mold growth on cheese, but mold spoilage has been a continuing problem. Researchers have shown the international method used to quantify Natamycin was flawed and reported active Natamycin when in fact none was present. As a result, now a more accurate alternative method can be used to correctly quantify Natamycin. In addition, research demonstrated that the package did not protect the Natamycin from ultraviolet (UV) light which rapidly degrades this natural anti-mold ingredient. Improved methods of applying Natamycin and improved packaging that blocks UV light will be effective in reducing mold on non-vacuum packaged cheeses. A decrease of 1 percent in the amount of shredded cheese that is kept from mold spoilage represents 21.3 million pounds of cheese that remains available to United States consumers.

**Improved Bread Making.** This study has found ways of adding soybean peroxidases to wheat flour to significantly improve a flour's protein quality and bread-making characteristics. This overcomes the problem with many commercial wheat flours that are unsatisfactory for bread making purposes because of low protein content and/or low protein quality.

**Food Product Analyses.** Food processors in Virginia need guidance on the formulation, processing, packaging, and handling of their food products to produce safe and wholesome products that are in compliance with state and federal laws. As a result of food process analysis, 269 food products produced by 61 Virginia food enterprises were analyzed and

recommendations provided. Ninety-four required significant modification to be legal and safe. Seventy-four products had food safety issues that, left uncorrected, would have resulted in unsafe food in the marketplace. Twenty products had significant quality issues that would have resulted in economic loss for the processor.

**Improving Shelf Life and Quality of Peanuts.** Virginia peanut growers and processors need techniques to increase the value of their food product. Researchers have shown that substantial improvements in shelf life and quality can be achieved when switching from traditional to high oleic varieties. As a result, peanut skin extracts can act as natural antioxidants in cooked meats, opening the door for potential development of new food additives from waste peanut skins and allowing the Virginia peanut industry to maintain a lead in peanut quality.

**Better Food Process Control.** In the early 1970s there were three significant outbreaks of botulism in canned foods in the United States. This led to a change in the food inspection system that put the burden of producing safe foods upon the food manufacturer. The Food and Drug Administration's (FDA) role was changed to one of oversight with unannounced inspection of records and procedures. By attending and certifying at "Better Process Control Schools," food processors are in compliance with federal regulations and produce a safe food product. In 2005, two courses were delivered and a total of 60 students were trained. One hundred percent of the participants passed the required examinations and are now recognized by FDA as a certified supervisor. Without this certification, they could not legally process their product.

**Insuring Juice Safety**. Identifying alternative processing technologies that may serve as a feasible alternative to thermal pasteurization could provide many juice processors, particularly small operations, with an economically viable means of complying with federal juice Hazard Analysis and Critical Control Points (HACCP) requirements. Many small processors, the primary beneficiaries of this research, are located in rural settings that benefit economically from such businesses. Providing alternative processing options, and the education to implement them, could allow small juice processors to continue processing juice products and improve the fiscal stability of such companies.

**The Poultry Food System: A Farm to Table Model.** Food processors and regulatory authorities want quantitative means to determine the presence of *Listeria monocytogenes* in the plant environment. When present, this organism is often at relatively low frequencies and concentrations. Research results will aid the development of sampling protocols that maximize the survival and recovery of *L. monocytogenes*. Processors will have greater assurance that their sampling plans can detect the presence or concentration of *L. monocytogenes*.

**Prevention and Reduction of Microbial Pathogens.** Strains of *Listeria monocytogenes* may have reservoirs in poultry processing plants. They may also undergo genomic diversification within the plant, which needs to be taken into consideration in the analysis of their ecology and epidemiology. Researchers are identifying relevant critical control points for these select pathogens in turkey processing plants, which will aid in developing methods to effectively eliminate these pathogens from the processing environment. Poultry growers and researchers can now optimize their sampling methods and sampling plans and improve their ability to detect and control this pathogen.

**Reducing Bacteria on Chicken.** Exposure of boneless, skinless chicken breasts to ultraviolet (UV) radiation may not significantly benefit the keeping quality or the shelf life of this product. While the UV treatments had a minimal impact on the taste of cooked chicken breast, these treatments would not be an effective way to reduce bacterial numbers on raw chicken. The use of alternative antimicrobial and surfactant chemical sprays, including Cetylpyridinium chloride, for pre-chiller chicken carcasses can decrease the incidence or concentration of microbial pathogens on these carcasses and improve food safety.

**Improvement of Thermal Processing of Food.** This past year, efforts focused on the development of non-destruction evaluation of popping ability of corn kernels. Ultrasonic parameters (velocity and attenuation) were measured on corn kernels that were subjected to different storage conditions resulting in three moisture contents and types of kernel damage. The kernels were popped individually using a microwave oven in a special sample holder. Using the combination of velocity and attenuation values to predict the popping ability of corn kernels resulted in an 80 percent prediction success. Adaptation of such method would result in economic savings in the corn processing industry.

**Determining Oyster Shelf Life**. Shell stock oysters stored at 4 and 7 degrees C were sampled between 0 and 14 days. Unique smell-prints of oysters over a period of 14 days were produced. Recognition patterns were distinguishable with the e-nose. Correlation of sensory panel scores and microbial enumeration with the e-nose readings proved promising, indicating that the system can be considered a qualified candidate for oyster quality assessment. The development of non-destructive and non-contact e-nose based oyster quality evaluation will benefit the oyster processing industry by avoiding economic losses and will also address the safety concerns of consuming spoiled products.

**Reducing Fat Uptake in Fried Foods.** This study has demonstrated that frying with nitrogen gas, compared to steaming, and incorporating an edible film coating into the pre-dust significantly increases the crispness of breaded fried chicken nuggets. In addition, there are clear advantages of using nitrogen as a pressurizing medium, including economic benefits due to the Extension of the oil fry-life, reduction in product waste from using smaller fry loads, and the willingness of consumers to pay a little extra for products fried using nitrogen gas. By adapting the suggested modifications to the existing fryers in restaurants, there could be a significant reduction in oil waste, and the resulting value-added products will bring additional revenue to the food industry.

**Increasing Youth Knowledge in Food Processing.** Thirty-two youth increased their knowledge of food quality and processing as a result of participating in the Food Product Development Contest. Thirty high school students increased their knowledge of the processing, safety, and quality areas of dairy foods as a result of participating in the Virginia Dairy Foods Career program.

***Food Safety and Food Borne Illness***

Food safety is a concern that affects everyone and must address issues from farm to table. The prevention of food borne illness is a major responsibility of food producers, processors, distributors, retailers, and regulatory agencies. Virginia Tech and Virginia State University faculty played a major role in meeting the goal of producing safe food products for Virginia, national, and international markets. Faculty developed internally adopted principles and conducted training programs for producing, processing, and marketing safe food products. Virginia Cooperative Extension also addresses food safety through workshops with agents, farmers, producers, processors, distributors, retailers, families, and consumers. Extension personnel are working directly with each clientele group on food safety issues. Our undergraduate and graduate students were taught the principles of food safety in most classes, including: food microbiology, food processing, advances in food microbiology, dairy processing, quality assurance, poultry processing, and veterinary toxicology.

**Bilingual Video for Food Preparation Safe Temperatures**. Continued efforts are needed to provide food safety education to the retail food and foodservice industries. High employee turnover and increasing numbers of workers who do not read English can hinder effective training. Through the Virginia Food Safety Task Force, simplified food safety messages (directions, warnings, and reminders) have been developed in the form of stickers, magnets, and videos. An animated video (English and Spanish versions) was developed to remind consumers and food preparers about the concept of keeping your meat products and other foods safe by holding and storing them at the proper temperature. The video distributed to foodservice companies and used as a television public service announcement encourages food preparers to maintain proper food temperature control to keep products microbiologically safe. The video message is relevant indefinitely and has the potential to be viewed by millions of individuals. Retail food workers and food consumers, who may or may not read English, can easily understand and comply with the message to ensure safe food handling and preparation.

**HACCP Training for Chinese Agricultural Food Safety Delegation.** China is a significant agricultural trading partner with the United States. Trade relations between these countries will be facilitated if China understands or cooperates with United States food safety programs including Hazard Analysis and Critical Control Points (HACCP) and Good Agricultural Practices (GAPs). A one-day training course on HACCP and other food regulatory issues was provided to 26 members of a visiting agricultural food safety delegation from China. Government, industry, and academia representatives now have additional knowledge, contacts, and resources to help them implement or comply with HACCP programs for preventing their products from becoming a source of food borne illness and ensuring compliance with United States regulations. Ninety-five percent of food distributors who have been certified in HACCP indicate they have shared their educational material with more than 10 people in their facility and 400 people increased adoption of food safety principles by utilizing HACCP principles. One hundred percent of the food distributors who have been certified in HACCP have indicated they have passed subsequent state and federal inspection of their facilities for compliance with HACCP and food safety regulations.

**Microbial Food Safety Risk Assessment and Intervention for Hydroponically Grown Sprouts.** In FY2002, the Virginia State University Agriculture Research Station (VSU-ARS) established a Food Safety Research Program. The initial project under this Program is entitled "Microbial Food Safety Risk Assessment and Intervention for Hydroponically Grown Sprouts." Sprouts are highly value-added agricultural products that can be hydroponically grown the year around. In recent years, however, contaminated sprouts have caused numerous outbreaks in the United States and around the world. Since 1995, at least seven outbreaks of *Salmonella* infection and two outbreaks of *Escherichia coli* 0517 have occurred in the United States due to the consumption of contaminated sprouts. The unfortunate reappearance of sprout-linked disease outbreaks since the year 2000 emphasized the need for additional food safety research on sprouts. One particular area that has not been thoroughly evaluated is the safety of small-scale sprout production at home or in retail stores, the focus of the VSU-ARS research. Many small or mini-scale sprouting systems have been developed in recent years and promoted via the Internet. User instructions with these advertisements seldom fully address the associated food safety risks. Furthermore, microbial sampling and testing procedures that are being recommended for wholesale scale production are impractical for most home or retail-scale growers. This new VSU-ARS research project will enhance the safety of hydroponically grown sprouts. In 2005, the final year of this project, VSU-ARS evaluated sprouting seeds (broccoli, green peas, lentil, mung bean, mustard, radish, red clover, soybean, and triticale) for their antimicrobial activity toward *B. Cereus*. In conjunction with some previous results, we found that 1) the antimicrobial activity of legume seeds (such as red clover) may be utilized in sprout or food production systems for preventing *Bacillus cereus* related food poisoning; 2) acidic sprays, when applied to either in-shell or shelled almonds, can significantly reduce *Salmonella* contamination; an estimated five-log reduction may be achieved using various combinations of shelling, spraying, and storage treatments; and 3) bacteriophage treatment has the potential to be developed as a biological method for enhancing sprout safety. These data could help seed and sprout producers as well as future research to generate effective seed decontamination treatment to ensure seed and sprout safety. Over the three-year life of this project, three referred research journal articles were published in the *Journal of Food Science*, with one article accepted from work done in 2005. Four major research presentations were made at regional and national professional meetings.

**Food Service Safety Workshop**. A four-hour food safety workshop was delivered to food service workers in the City of Martinsville. Eighty-five percent of 50 workers increased their knowledge on how to properly prepare sanitizer solutions, 100 percent increased their knowledge on how to properly wash their hands, and 75 percent increased their knowledge on food safety and evaluation techniques.

**Developing Alternatives to the Use of Sub-Therapeutic Antimicrobials**. The spread and transmission of antimicrobial-resistant microorganisms from animals to humans is a major public health threat posed by the use of antibiotics at sub-therapeutic levels in livestock dietary formulations. To date, no alternative methods have been developed that would allow the livestock industry to abandon this practice without compromising current productivity standards (i.e., time to market, feed efficiency, and morbidity rates). In the Nutritional Immunology and Molecular Nutrition laboratory, we are studying the immune response to antimicrobial-resistant and antimicrobial-sensitive strains of *Salmonella enterica serovar Typhimurium* from a host-pathogen interaction perspective. We are developing a system to track anti-*Salmonella* specific

immune responses in vivo in pigs challenged with a mixture of resistant and sensitive *Salmonella*. These experiments are the basis for future projects aimed at designing nutritional and immunological interventions that increase food safety and to effectively monitor exposure to antimicrobial-resistant bacteria in meat samples.

**Control of Coccidiosis in Commercial Poultry.** In the modern commercial poultry industry, increases in disease and infections by enteric pathogens are a persistent concern. In particular, infections caused by coccidial parasites have had a major economic impact on the commercial broiler industry. It has been reported that the United States' poultry industry suffers in excess of one to two billion dollars in annual losses relating to coccidial treatment, infection, and prevention. Historically, coccidial parasites have been controlled through the use of in-feed coccidiostats. However, through the years, drug-resistant strains of coccidia have emerged. The concern with these vaccines has been the impact on performance (body weight and feed conversion) resulting from the infection in the birds and the level of complete protection generated by the vaccine for subsequent immunity when the birds are exposed to other coccidial strains in the environment of commercial poultry production facilities. Our research indicates live coccidia vaccination was effective in generating immunity to a subsequent coccidia exposure with no negative impact on bird performance. This provides an alternative for the traditionally used anticoccidial drugs.

**Safer Goat Milk**. Researcher found that ultraviolet (UV) light could achieve a greater then five-log reduction of *Listeria monocytogenes* in raw goat's milk. Future research will assess lipid and protein oxidation and organoleptic properties of the irradiated milk. This technology will give smaller dairy processors a more economical way to pasteurize their milk, which will increase economic viability in rural areas.

**Food Safety Signage Program.** As a result of Extension's coordination and development of food safety placards and stickers in English and Spanish, hundreds of foodservice and retail food establishments have adopted the system of signs, which has improved food safety. The educational program is focused on food handling, cleanliness, personal hygiene, and analysis of safe food products.

**Food Product Recall Training**. When adulterated or misbranded food products that have been marketed are identified, they must be recalled. Failure to quickly and efficiently recall product may result in losses for the company and consumers affected. Delays may result in illnesses, disruption of food processing, and greater economic burden. Food recalls cost United States companies millions of dollars annually. The companies which have a recall plan in place will prevent loss more effectively than those who do not. Working with industry and the Virginia Department of Agriculture and Consumer Services, a 2.5-day course was developed and delivered to 22 Virginia food companies and nine United States distributors. As a result, 100 percent of the companies reported they are better prepared, 78 percent are developing a recall plan, and 22 percent are modifying an existing plan.

**4-H Teen Mentorship Program.** Virginia Cooperative Extension enrolled and trained 6,021 adults and 11,735 youth in the statewide, hands-on, Smart Choices Nutrition Education Program (SCNEP), which resulted in 65 percent of participants demonstrating improvement in one or more food safety practices.

**Consumer and Food Service Food Safety Education.** The Center for Disease Control and Prevention (CDC) estimates that food borne disease causes an estimated 76 million illnesses and 5,000 deaths in the United States annually. From 1993 to 1997, Virginia had 55 confirmed food borne disease outbreaks, which ranked a distant second among the southern states (Florida reported 210). ServSafe Essentials is a 16-hour training that targets food service managers, supervisors, and food handling personnel and improves their knowledge and skills in safe food handling practices in order to pass a national certification exam. Six hundred fifty-two food service managers and employees increased their knowledge of proper food handling through participating in Virginia Cooperative Extension's ServSafe Food Sanitation Program. As a result, 88 percent of the learners successfully completed the 35-course food safety certification from the National Restaurant Association, which provided necessary workforce skills, and food safety permits for food service enterprises (80 percent is the national average).

**Detection of Fecal Pollution in Oyster Beds.** Over the past 20 years, there has been a steady increase in shellfish/oyster beds in Virginia waters being condemned and closed to harvest due to fecal pollution. There are many causes, including ever-increasing development of waterfront properties and sewage treatment facilities in cities operating over capacity due to population growth. At the same time, Virginia has made a commitment to restore condemned shellfish harvest areas and preserve some part of the historic "waterman" culture. Research from our source-tracking program has provided the Division of Shellfish Sanitation (DSS), Virginia Department of Health (VDH), with methodologies to detect and identify the sources of pollution in shellfish beds in coastal waters, including the Chesapeake Bay. The methods include screening waters with fluorometry to detect optical brighteners (OBs) used in laundry and dishwashing detergents (human-origin pollution). For condemned shellfish beds where OBs are present, an intense water sampling protocol has been developed to help identify the exact location where the OBs originated. For beds where OBs are not present, other sources of fecal pollution such as birds, livestock, or wildlife, can be identified with DNA fingerprinting techniques. The protocols adopted by DSS from our research program have provided the agency with the ability to accurately identify sources of pollution so that money spent to improve water quality will be directed toward the correct sources of the problem.

**Fruit and Vegetable Microorganisms.** Fresh fruits and vegetables have been increasingly associated with outbreaks of food borne illness. Microorganisms on the surface of raw produce may be difficult to remove for decontamination or microbial sampling due to porous surfaces and entrapped or attached cells. Researchers examined the efficacy of sonication and detergent rinses for enhancing the removal and recovery of bacterial pathogens from produce surfaces. A related project examined techniques to enhance the recovery of pathogens, including Salmonella, from raw produce by comparing alternative sample diluents, diluents temperatures and ultrasonic treatment of diluents.

**Measuring Microbial Contamination.** Research focused on the measurement of the surface area of raw produce to enable improved quantitative measurement of surface microbial contamination. A new imaging system has been used to provide rapid measurement of the surface area and volume of various raw fruits and vegetables. Measurement of raw produce with this system led to the development of models to predict surface area from raw product weight. Therefore, food microbiologists will be able to conveniently analyze the entire surface of irregularly shaped fruits or vegetables using a measurement of the weight of whole raw product. Researchers and food processors can report and compare surface microorganism concentrations based on product surface area rather than volume of product rinse. It will improve estimates of consumer exposure to pathogens from ready-to-eat produce consumption and more effectively target interventions to reduce this exposure.

***Food Borne Pathogen Protection***

**Reducing Contamination in Processing.** Surface food microbiology projects have explored methods to prevent bacterial food borne pathogens from contaminating food processing plant environments and reduce the level of these pathogens on raw and finished product surfaces. For example, researchers compared the effectiveness of new and established antimicrobial chemical treatments for inactivating or preventing the attachment of pathogenic *Campylobacter* bacteria to chicken skin. This research can be used by the poultry processing industry to control the incidence or levels of *Campylobacter* in raw chicken and turkey. Poultry products are considered the leading source of *Campylobacter,* and poultry processors anticipate that the federal government will implement industry performance standards to limit this pathogen in raw poultry.

**Improving the Safety of Ready-To-Eat Meats**. Development of recommendations for the use of antimicrobial agents in combination with ultraviolet light in the treatment of chill brines will aid ready-to-eat meat processors in determining appropriate strategies to control the food borne pathogen, *Listeria monocytogenes.* Identification of appropriate antimicrobial levels for use in combination with alternative processing technologies for the treatment of chill brines may provide meat processors with a means of controlling food borne pathogens at a critical post-processing contamination point.

**Food Safety for Occasional Quantity Cooks.** Food safety for occasional quantity cooks is equally as important as food safety at home or in restaurants. A total of 380 individuals representing community volunteer organizations (including churches, community agencies, volunteer rescue squads, and fire departments) across the Commonwealth received six hours of training by Virginia Cooperative Extension. As a result, 95 percent were certified for five years by the Virginia Department of Health. As a result, the individuals and organizations practice safe food handling and also receive permits to operate food service programs.

***Food Security***

**Rapid Response--Composting Animal Losses.** An avian influenza (AI) outbreak in the central Shenandoah Valley of Virginia in the spring and summer of 2002 affected 197 poultry farms and cost $130 million to the poultry farmers and state economy. In 2003, more than 3.1 million of the 4.7 million birds infected, or 13,000 tons, were disposed of in landfills. Producers needed cost-

effective methods to dispose of infectious bird carcasses. As a result of on-farm research and demonstrations by Virginia Cooperative Extension, composting birds for disposal has become an accepted practice and a viable alternative to landfilling. Composting costs $45.00 per ton compared to $145.00 for landfilling. An additional benefit of on-farm composting of catastrophic losses is that it does eliminate the biosecurity risks of transporting carcasses off the farm.

**Biosecurity in the Poultry Industry**. In 2003, the poultry industry contributed more than $615 million to the Virginia economy, accounting for approximately 31 percent of all farm commodities. A 2001 outbreak of Low Pathogenic Avian Influenza (LPAI) in Virginia resulted in the destruction of over 4.6 million commercial poultry at an economic cost of more than $130 million. In order to create more favorable conditions for indemnity dollars should another similar disease epidemic occur, researchers and Extension faculty worked with the Virginia Poultry Federation to implement a Biosecurity Audit Program for all commercial poultry enterprises. The biosecurity audit procedure was implemented in 2004. In 2005, eight audits of all segments of live production for the commercial broiler and turkey integrators in Virginia were conducted. As a result, educational programming that will lead to improvements in biosecurity measures was provided for poultry growers, service personnel, and company management.

**Safeguarding Animal and Human Health.** Due to increasing food safety concerns, higher risks of agri-terrorism, and an increase in zoonoses, the National Animal Identification System (NAIS) was initiated to reduce the incidence and risks from foreign animal and emerging diseases. As a result of leadership provided by the Virginia Cooperative Extension Animal Identification Team, external funds were provided for the SafeTrak educational program, which provided training and resources for 120 Virginia Cooperative Extension agents and specialists. As a direct result of the training, Virginia Extension agents provided 300 educational programs for 19,000 producers, which resulted in the voluntary registration of 2,100 premises in over 100 localities in Virginia. As a result of increasing numbers of animal premises registrations in Virginia, producers and the animal industry will be better prepared in the event of a significant disease outbreak, and will have 48-hour trace back and trace forward capabilities to provide food safety protection.

**Safe Disposal of Animal Mortalities.** Shenandoah County Farm Bureau approached the Shenandoah County Board of Supervisors to request permission to compost large animal mortalities at the county landfill. The Farm Bureau cited concerns that a local rendering company had raised prices and may stop accepting large animal mortalities, as well as the fact that improper burial was increasing. Extension educational programs resulted in a proposal that outlined costs and pros and cons for large animal mortality disposal. Proper composting of large animal mortality was demonstrated on three farms. As a result, four producers have composted large animals on their farms. Between July 2004 and June 2005, the county accepted 130 animal carcasses at the landfill, 80 of which have weighed greater than 400 pounds.

**Shenandoah Valley Animal Agriculture Vulnerability.** With leadership from Virginia Cooperative Extension, an Animal Agriculture Vulnerability and Preparedness Assessment working group was formed to evaluate the vulnerability and regional preparedness for a food animal emergency or catastrophe in the Shenandoah Valley. As result of the assessment and planning, new infrastructure and plans have been put into place to better prepare for food animal

emergencies such as avian influenza, foot and mouth disease, or other catastrophic losses from natural disasters.

**Detecting Pathogens from Chickens**. This is a poultry food safety project, partnered with the Virginia-Maryland Regional College of Veterinary Medicine, to investigate sampling procedures for optimum recovery of *Arcobacter butzleri* from chickens and chicken houses. Environmental sampling was shown to be an effective, non-invasive method for detecting this emerging pathogen in infected chickens prior to transport to a poultry processing plant. Another bacterial pathogen of concern to poultry and other food processors is *Listeria monocytogenes*. Recent federal regulations have prompted a significant increase in environmental and product testing for this organism by food processors. Studying environmental sample storage time/temperature combinations for typical transport media will improve the qualitative and quantitative recovery of *Listeria monocytogenes*. Other research has examined the effectiveness of ozone for inactivating *Salmonella* on the surface of raw produce, ultraviolet (UV) light for inactivating *Campylobacter* on the surface of raw chicken, and UV light for inactivating *Escherichia coli* O157:H7 on the surface of raw produce. Each of these projects provided valuable information for the food industry and will focus future research efforts for preventing microbial food safety problems.

**Prevention and Reduction in Microbial Pathogens during the Production, Processing and Preparation of Poultry.** Production of edible poultry products during the continuum of farm rearing of birds through processing and preparation presents many opportunities for microorganisms to proliferate or contaminate raw products. This project seeks ways to prevent pathogenic bacteria from contaminating poultry products, to reduce the populations of microorganisms during processing, and examines sampling procedures to characterize a microbial population from live poultry. Strains of epidemic-associated clonal groups of Listeria monocytogenes may have reservoirs in processing plants, and that they undergo genomic diversification there, which needs to be taken into consideration in the analysis of their ecology and epidemiology. The results from this study will be used to identify relevant critical control points for these select pathogens in turkey processing plants, and to aid in developing methods to effectively eliminate these pathogens from the processing environment. This project demonstrated the relative effectiveness of microbiological sampling methods that may be used to detect A. butzleri from chickens or their environment. Poultry growers and researchers can now optimize their sampling methods and sampling plans to aid their ability to detect and control this pathogen. Exposure of boneless, skinless chicken breasts to ultraviolet radiation may not significantly benefit the keeping quality or the shelf life of this product. While the UV treatments had a minimal impact on the taste of cooked chicken breast, these treatments would not be an effective way to reduce bacterial numbers on raw chicken. The use of alternative antimicrobial and surfactant chemical sprays, including cetylpyridinium chloride, for pre-chiller chicken carcasses can decrease the incidence or concentration of microbial pathogens on these carcasses.

## Funding and FTE's

Extension Funding

| Year | Federal | State | Local | Other |
|---|---|---|---|---|
| 2000 | $236,863 | $661,824 | $118,830 | $100,502 |
| 2001 | $243,969 | $681,679 | $122,395 | $103,517 |
| 2002 | $251,288 | $702,129 | $126,067 | $106,623 |
| 2003 | $258,827 | $723,193 | $129,849 | $109,822 |
| 2004 | $266,592 | $744,889 | $133,744 | $113,117 |
| 2005 | $274,590 | $767,236 | $137,756 | $116,511 |

Research Funding

| Year | Federal | State | Local | Other |
|---|---|---|---|---|
| 2000 | $513,000 | $937,000 | $0 | $346,000 |
| 2001 | $529,000 | $965,000 | $0 | $356,000 |
| 2002 | $545,000 | $994,000 | $0 | $367,000 |
| 2003 | $561,000 | $1,024,000 | $0 | $378,000 |
| 2004 | $578,000 | $1,055,000 | $0 | $389,000 |
| 2005 | $595,340 | $1,086,650 | $0 | $400,670 |

Extension FTE's

| Year | Professional | | | Paraprofessional | | |
|---|---|---|---|---|---|---|
| | 1862 | 1890 | Other | 1862 | 1890 | Other |
| 2000 | 11.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2001 | 10.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2002 | 8.31 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2003 | 6.52 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2004 | 11.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2005 | 7.05 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Research SY's Only

| Year | 1862 | 1890 | Other |
|---|---|---|---|
| 2000 | 4.9 | 0.0 | 0.0 |
| 2001 | 4.9 | 0.0 | 0.0 |
| 2002 | 4.9 | 0.0 | 0.0 |
| 2003 | 4.9 | 0.0 | 0.0 |
| 2004 | 4.9 | 0.0 | 0.0 |
| 2005 | 4.9 | 0.0 | 0.0 |

## Goal 3: To achieve a healthier, more well-nourished population

Health and nutrition education issues are at the forefront of modern-day American life. Scientists, agriculturalists, and consumers realize and understand that environmental concerns – including water and air quality – directly impact human health and living standards. These concerns, coupled with other critical issues such as the aging population, childhood overweight, and disease prevention, provide a broad base for Extension research and programming opportunities.

Indoor air quality and environmental health issues are important in the maintenance of a sustainable and well-nourished population. One major topic of concern in recent years has been global warming and its relation to agriculture and the spread of disease. Youth in Northern Virginia were offered an educational program designed to teach the basic elements of indoor living quality while maintaining environmental stewardship. The effort resulted in the students understanding the effect of greenhouse gases on the progression of global warming, while offering solutions related to the slowing of this process.

In light of the recent hurricane disasters, water quality has been thrust into the spotlight. Testing, analysis, and research of the contaminants found in soils and water supplies can help prevent a wide range of chronic and infectious diseases. A new model to estimate bacterial loadings to land and streams was released and implemented this year. The Bacteria Source Load Calculator (BSLC) requires user inputs of animal population numbers, land use, and stream access on a sub-watershed level. The BSLC enables the user to perform accurate bacteria load source characterizations and improve the quality of watershed assessment plans. The Water Quality Education and Analysis Program provides Virginia residents the opportunity to have their water tested for a wide range of contaminants. The residents were then given specific information regarding health concerns and recommendations about how to improve water quality.

The environmental effects of ammonia emissions are critical in Virginia. A recent report by the National Research Council identified ammonia emissions from animal feeding operations as a major air quality concern at regional, national, and global levels, leading to increased health problems. Extension research is focused on quantifying the levels of atmospheric ammonia and implementing standards of practice to control the gas. Part of this research has resulted in the development of a process-based computer model that can be used to estimate the ammonia emitted from animal feeding operations. The model will help identify the most important parameters affecting emission rates and help design effective measures for protecting air and water resources from contamination, while enabling producers to remain profitable.

Air quality is also affected by the use of pesticides to control insect populations. Recently, hotels have been faced with growing bed bug infestations, which lead to loss of business and revenue. Cockroaches also continue to be a problem for public housing units, where pesticide sprays are the primary method of control. Pesticides can cause respiratory problems for people who are continually exposed to them. Because of this, Integrated Pest Management (IPM) is now being implemented around the Commonwealth. Extension agents offered training to administrators and principals in Hampton City Public Schools in order to teach the health benefits of this method of

pest control and ways to help local schools convert to IPM. As a result of this training, IPM has been implemented in all the City's school facilities.

The risk of cancer, cardiovascular disease, elevated blood pressure, and obesity, all major contributors to growing health care expenditures in Virginia, can be lowered significantly by a well-chosen and appropriate diet and active lifestyle. Research has shown that good diabetes management can help reduce or delay complications and thus, the cost of diabetes. Extension specialists at Virginia State University conducted workshops related to the management of this disease, resulting in the participants reporting more consistent blood glucose levels at the end of the eight-week program. Virginia State University also hosted an HIV/AIDS prevention workshop series to juvenile first offenders to educate them about this epidemic. An overwhelming majority of the students reported increased knowledge regarding the spread of the disease.

Nutrition and health education programs have been directed to all age and income levels. The segment of the population over the age of 65 is growing at a rapid rate. Educational programs based on raising nutrient intake improve the health of older Virginians, supports independent living, and reduces their risk of disease and disability. Exercise programs are also important to maintaining a healthy lifestyle. "Steps to Better Health," a 10-week program for overweight adults, and "Steps to Healthy Habits," a 10-week program designed to help reduce the risk of chronic disease, were successfully implemented by Extension agents across the Commonwealth.

Nationwide data show that overweight has increased two to three times among American youth in the past 30 years. Children who are overweight are more likely to suffer from serious health problems such as Type 2 diabetes and asthma. Healthy Weights for Healthy Kids (HWHK) was developed to provide Extension educators with a hands-on and user friendly curriculum to prevent overweight. The results of this program showed significant increases in health knowledge, attitude, and behavior scores for most students.

Significant resources are devoted to assisting limited-resource families as part of the Expanded Food and Nutrition Education Program (EFNEP) and the Smart Choices Nutrition Education Program (SCNEP). EFNEP works with young families and their children to educate them about good nutrition practices, how to prepare nutrient dense foods, and how to keep from running out of food toward the end of the month. SCNEP works with people whose incomes are at 130 percent of the poverty guidelines and/ or receive food stamps, teaching them good nutrition practices, sound food safety behaviors, and like the EFNEP, how to prepare nutrient dense foods, and how to keep from running out of food toward the end of the month. In addition, 26 impoverished children from public housing developments were sent with privately donated funds to the five-day "Kids Café Camp," to learn about nutrition, health, and wellness.

Virginia Cooperative Extension assists families and communities with critical issues related to economic stability and self-sufficiency, positive growth and development of human capital, and improved food and nutrition for a healthy, productive society.

Research and Extension outputs generated as part of this goal included: three refereed journal articles, 37 numbered Extension publications, one dissertation, and three other reports.

This section highlights the 2005 accomplishments of Virginia Tech and Virginia State University in achieving a healthier, more well nourished population. Eight theme areas are included in Goal 3:

- Indoor Air Quality and Environmental Health
- Pest Control and Communicative Diseases
- Human Health
- Nutrition Education for Adults
- Physical Activity and Fitness Programs for Adults
- Healthy Weights and Fitness in Youth
- Expanded Food and Nutrition Education Program (EFNEP)
- Smart Choices Food and Nutrition Education Program (SCNEP)

## *Key Themes*

### *Indoor Air Quality and Environmental Health*

**Home Energy Use.** In Arlington County, youth participated in an educational program designed to teach the basic elements of indoor living quality while maintaining environmental stewardship. A lesson was presented for fourth graders on climate change and actions that families can take to slow the effects of global warming. Out of 48 evaluations, 94 percent could define the greenhouse effect, 96 percent accurately identified carbon dioxide as a greenhouse gas, 96 percent understood that riding in a car sends greenhouse gases into the atmosphere, and 98 percent could list at least one change that could result because of global warming. In an experiment designed to demonstrate the greenhouse effect, 86 percent of the students understood why a thermometer inside an empty soda bottle got hotter than a thermometer outside the bottle.

**Bacteria Source Load Calculator (BSLC): A Tool for Bacteria Source Characterization for Watershed Management.** A new model to estimate bacterial loadings to land and streams was released. The spreadsheet-based Bacteria Source Load Calculator (BSLC) assists Total Maximum Daily Load (TMDL) developers in generating bacterial loadings from livestock, human, and wildlife sources. The BSLC is used for developing TMDLs for a water body impaired by bacteria (pathogens). The calculator generates input files for non-point source pollution (NPS) and direct NPS bacterial loads required by the Hydrological Simulation Program FORTRAN model (HSPF). The BSLC can be customized to provide inputs to other similar watershed-scale water quality models. The calculator requires user inputs of animal numbers, land use, and stream access on a sub-watershed level. The flexibility and functionality of the Bacteria Source Load Calculator enables the user to perform accurate bacteria load source characterizations and improve the quality of watershed assessment plans. Further, BSLC reduces the time and cost needed to develop bacteria impairment TMDLs, greatly speeding up the process of generating fecal coliform inputs and allowing the user to easily make changes to sub-watershed level inputs to produce new bacteria source input files. We estimate that using the BSLC can reduce the time required to develop bacteria source load inputs and perform model calibration and TMDL allocation runs by between one and six weeks, depending on the

complexity of the watershed being modeled. Additionally, using the standardized procedures and automation provided by the BSLC reduces the possibility of human error.

**Identifying Source of Fecal Pollution in Virginia's Public Beaches**. Microbial source tracking (MST) was deployed during the 2004 swimming season in response to numerous beach closures due to high fecal bacterial counts. MST indicated consistent pollution from human sources on three beaches in the city of Newport News. During the off-season, sewage leaks and/or cross-connections on these beaches were discovered and corrected by city and health officials. Further use of MST in conjunction with beach monitoring in 2005 allowed for: 1) further testing of fluorometry as a method to detect human wastewater in storm drain outfalls and open beach waters; 2) the first field test of the newly developed polymerase chain reaction (PCR) based DNA fingerprinting method; and 3) an evaluation of the success of remediation efforts conducted between the 2004 and 2005 swimming seasons. Results from the summer of 2005 showed that none of the beaches tested displayed definitive human-origin pollution using any of four MST methods, confirming the success of off-season remediation efforts. Bacterial isolates from most beaches were identified primarily as bird in origin, although moderate dog and/or wildlife source pollution was often detected as well. This project demonstrated that a combination of MST methods could accurately pinpoint sources of fecal pollution in beach waters.

**Water Quality Analysis and Education.** Through Virginia Cooperative Extension's Water Quality Education and Analysis program, residents were able to have their water tested for a wide range of contaminants. These tests determined the quality of their drinking water. Some tests such as fecal coliform bacteria and total coliform indicate immediate problems if present in water sample results. Other tests reflect concerns with prenatal health such as tests for nitrates and lead. As a result of this program, 33 persons were able to determine the quality of their drinking water. Each family was provided with the acceptable ranges as established under the EPA water quality guidelines to compare to their personal results. Thirty-three residents have improved understanding of water quality standards and specific recommendations for corrective actions that will protect human health.

**Ammonia Emissions**. A recent report by the National Research Council identified ammonia (NH3) emissions from animal feeding operations (AFOs) as a major air quality concern at regional, national, and global levels. Elevated levels of atmospheric NH3 can cause negative environmental effects such as surface water eutrophication, foliar damage, and soil acidification. Atmospheric NH3 also plays a key role in the formation of fine particulate matter (PM2.5), which can cause aggravated asthma, chronic bronchitis, and decreased lung function. To date, only a few studies have directly measured NH3 emissions from AFOs in the United States. Therefore, it is imperative to quantify NH3 emissions to estimate the contribution of AFOs to the national NH3 inventory. In addition, science-based NH3 emissions data are needed to develop and implement emissions control techniques to help producers meet regulatory demands. Ammonia emissions from turkey grow out houses have been monitored for limited periods. Litter management appears to be the key to reducing NH3 emissions from turkey housing: NH3 emission rates from grow out houses with used litter were 57 percent higher than those with new litter. The use of new litter will be recommended to turkey producers as a best management practice to reduce NH3 emissions for turkey housing. Implementation of this recommendation

will help protect producers from lawsuits and regulatory action and will help protect air quality in areas of intense turkey production.

**Development of an Improved Process-Based Ammonia Model for Animal Feeding Operations**. Ammonia emitted from animal feeding operations (AFOs) is a critical issue because deposition of excessive ammonia from the atmosphere can have negative impacts on the environment including: eutrophication of surface waters, contamination of drinking water, and soil acidification. Ammonia can react with acid compounds in the atmosphere to produce particulate matter, which may contribute to poor visibility. Additionally, the particulate matter can cause respiratory disorders in humans and livestock. Ammonia loss from manure also represents loss of fertilizer value. Estimating ammonia emission rate from AFOs is important for both regulatory agencies and animal producers. An hourly/daily ammonia emission rate, which has on-farm and local air-quality impact, is needed to assess its contribution to the dynamics of air quality at different times of the year, so that effective and specific emission-control strategies can be developed. We are developing a process-based computer model that can be used to estimate the ammonia emitted from an AFO. This model will be used to estimate the ammonia emission rate in response to specific on-farm practices regarding animal feeding and manure management practices and environmental conditions, identify the most important parameters that affect ammonia emission rate, and therefore, help design effective measures for reducing the emission rate to protect air and water resources from contamination.

**Animal Manure Management for Bioenergy and other Value-added Products.** Management of extensive animal manure is an important challenge facing the United States and Virginia's animal industry. Currently, animal manure is predominately disposed of through lagoon storage and subsequent land application, which can cause environmental problems such as odor, greenhouse gas emission, and nutrients accumulation. This research focuses on utilizing animal manure as raw material for producing a variety of value-added products and bioenergy including high quality fiber as soil amendment, slow release fertilizer, and biogas. Several technologies will be used including high rate anaerobic digestion, chemical precipitation for struvite formation, and enhanced composting. This project will benefit Virginia's animal industry by converting animal manure from a waste material into value-added products, and reducing the tipping fee involved in traditional manure management practices.

**Biosolids.** Biosolids (i.e., treated sewage sludge) and other municipal, agricultural, and industrial wastes are frequently applied to soils as conditioners and fertilizers rather than being discarded in landfills or incinerated. Some scientists have expressed concerns that heavy metals applied to the soil in such wastes will become increasingly toxic or mobile. This could result in 1) greater metal uptake by plants and transfer of these potentially toxic elements into the food chain, 2) reduced growth and health of plants grown in waste-amended soil, and/or 3) increased leaching to groundwater, where drinking water quality could become compromised. Our study shows that the bioavailability, mobility, and toxicity of potentially hazardous heavy metals is decreasing or remaining at the same benign effects two decades after high application rates of biosolids containing considerably higher concentrations of heavy metals than is typical in currently produced biosolids. Our work supports the contention that biosolids are an inexpensive and beneficial source of organic matter and nutrients for sustainable farming.

**Nutrient Management Plans.** Virginia-employed Nutrient Management Specialists, who have been trained by Virginia Cooperative Extension specialists with water quality and waste management responsibilities, completed 491 nutrient management plans, which covered 76,934 acres and resulted in the reduction of 225,014 pounds of nitrogen and 112,069 pounds of phosphorus in 2004. Virginia Cooperative Extension specialists also contributed toward the training of an additional 278 persons who became certified Nutrient Management Planners.

**Environmental Management Checklist**. Upon recommendation of the Dairy Environmental Stewardship Council and with their input, a Dairy Producer's Environmental Management Checklist was sent to all 850 Grade A milk producers in Virginia. Material was laminated for durability. The result is a self-assessment instrument on every Virginia dairy farm with emphasis on animal waste storage, field application, and water runoff management. An increased awareness of environmental impacts due to waste handling was established. In addition, a laminated Emergency Action Plan was sent with the self-assessment.

**Farm Tour, Waste System Demonstration, and Dairy Environmental Stewardship Council.** Environmental issues have become major considerations for Virginia dairy farmers. To address this issue, the Virginia Tech dairy was used as a site to demonstrate state-of-the-art technology related to waste handling. During a tour and field day conducted in July 2005, manure composting, waste removal by flushing with water, and aeration as a means of controlling odors were demonstrated. Attending were many federal (NRCS) and state (DCR) personnel in addition to dairy farmers and dairy professionals. The Dairy Environmental Stewardship Council met in conjunction with this field day and brought together conservation, regulatory, and production interests. The result has been specific recommendations for dairy Extension programming resulting in clarification of current regulations and future areas of interest.

***Pest Control and Communicative Diseases***

**Study Evaluating the Efficacy of Current Bed Bug Control Products**. This is the first study in the nation to provide bed bug control recommendations to the pest management industry and the public. It was completed at Virginia Tech during the reporting period. The bed bug, a blood-feeding parasite, was a major household pest at the turn of the 20th century. The importance of the bed bug diminished in the 1950s with the use of pyrethrum insecticides and DDT. However, in the late 1990s bed bug infestations began to make news as an emerging pest problem in 5-star hotels. Hotel guests reported waking up covered in red, itching bites. Although bed bugs do not transmit disease, people find it unacceptable to be bitten while sleeping in a hotel. Several lawsuits, in excess of a million dollars, have been settled in favor of plaintiffs bitten by bed bugs. What began as a few scattered reports in the 1990s became a full-blown epidemic in 2005. Bed bugs are easily transported from one location to another, and they are now found all over the United States in hotels, dorm rooms, campgrounds, cruise ships, and homes. Because bed bugs have not been a problem for over 40 years, relatively few pesticides are labeled for their control, and none have been evaluated for efficacy. To evaluate these products, bed bugs were reared for testing. Bed bug rearing is difficult due to their blood-feeding habits and Virginia Tech's laboratory is currently one of only two university laboratories rearing bed bugs for research purposes in the United States. In December 2005, the first article to appear regarding this research was published in the *Journal of Economic Entomology*. Data have also been presented

at four professional meetings. These data represented the first empirical study of bed bug response to insecticides since 1966.

**Assessing the Value Residents of Public Housing Put on IPM (Reduced Toxicity Treatment) for German Cockroach Control.** Poor sanitation contributes to continual cockroach problems in public housing. Many residents are children or elderly and sensitive to bronchial contaminants. Pesticide sprays are the primary method of cockroach control in public housing because sprays are inexpensive. Yet, environmental costs may be significant. Concerns about health risks associated with pesticides have stimulated the use of Integrated Pest Management (IPM) for cockroach control. It has been assumed that IPM is too expensive to use in public housing, but the benefits (reduced insecticide use and lower cockroach numbers) may offset the costs. Most public housing residents are unaware of the benefits of IPM. A survey was conducted by Virginia Cooperative Extension faculty to introduce residents to IPM and ask them to assess its value. A total of 816 face-to-face surveys were conducted in Portsmouth, Charlottesville, and Roanoke. Surveyors introduced residents to the IPM concept, informing them how IPM might improve the quality of their home. Residents were asked how much additional rent they would be willing to pay for IPM. After learning about IPM, 462 respondents indicated that they would be willing to pay an additional $11.32 (average) per month for IPM. Some residents (140) would not pay because they could not afford to. These residents indicated that IPM had value, but that the housing authority should pay for IPM. One-half (429) of the residents indicated that someone in their household had respiratory problems; 224 responded that someone in the home went to the hospital for breathing difficulty within the last two years.

**Virginia School IPM Training Program for the Principals and Administrators of Hampton City Public Schools**. There has been a growing national concern about childhood exposure to pesticides. Many states have mandated the adoption of IPM use in schools. In Virginia, there are 1,836 public schools, serving 1,176,577 students and employing over 200,000 staff. In 1999, Virginia schools were treated monthly with insecticides regardless of need. In addition, schools kept no records of pesticide applications. While IPM was not mandated in Virginia, there was a critical need to improve pest management practices. To meet this need, a School IPM program was developed tailored to train three client groups who each had a role in IPM: Extension agents, pest management professionals, and school personnel. The purpose of the training was to teach clients how to help their local schools convert from monthly pesticide applications to an IPM program. Since 2000, the training has resulted in 14 school districts adopting IPM in 909 buildings, reducing pesticide use by 79 percent, and improving the quality of the work environment for 67,700 employees and 455,000 students. In February 2005, a School IPM training program was presented to the administrators and principals of the Hampton City Public School district. This training was a follow-up to a program presented to the Hampton facilities personnel in December of 2004. The 2005 training was intended to facilitate the adoption of an IPM policy in Hampton City Schools. As a result of this training, Hampton City Schools adopted IPM in all of its 43 facilities, thus improving the environmental safety and quality for 22,000 students and 3,500 employees.

### *Human Health*

**Diabetes.** Diabetes is a growing public health problem. According to the Center for Disease Control and Prevention (CDC), more than 20 million Americans have diabetes, the sixth leading

cause of death in the United States. Those demographic groups most affected by diabetes are the elderly, women, and certain racial and ethnic groups. African American, Hispanic, American Indian, and Alaska Native adults are two to three times more likely than white adults to have diabetes. The financial impact of diabetes in the United States is nearly $132 billion a year. The CDC reports that the yearly health care cost for a person with diabetes in 2002 was $13,243 compared with $2,560 for a person without diabetes. In 2002, diabetes costs represented 11 percent of national health care expenditures. Research has shown that good diabetes management can help to reduce or delay complications and thus, the cost of diabetes. Virginia State University conducted a series of eight classes under the theme, *Fitting Together the Pieces of Diabetes* to give diabetics and those at-risk of diabetes information on nutrition, physical activity, and methods for managing diabetes complications. A total of 147 persons participated in the classes. In one group, 70 percent of the participants reported more consistent blood glucose levels by the end of the eight weeks and 100 percent indicated they felt confident about keeping their diabetes under control through diet, exercise, and proper monitoring.

**HIV/AIDS.** In the United States, African Americans make up 12 percent of the population; yet, according to the Office of Minority Health (OMF) they comprise 51.7 percent of estimated AIDS cases diagnosed in 2002. This rate is almost ten times the rate for whites and almost three times the rate for Hispanics. According to the Centers for Disease Control and Prevention (CDC), HIV/AIDS is one of the three leading causes of death for both African American men and women ages 25 to 44. Research shows that the public is well informed about certain aspects of the HIV epidemic--most know that there is no cure for AIDS, that there are drugs that can extend the life of those with HIV, and how the virus is transmitted. Most however, do not know some of the key prevention and treatment issues. Education is one of the most effective ways to help fight the stigma, fear, and denial that surround HIV/AIDS. Those communities disproportionately affected by HIV/AIDS must receive the education, prevention, testing and treatment needed to help stop the spread of the virus. A Virginia State University Health Specialist held three one-hour HIV/AIDS and STI workshops for teens in a juvenile justice first time offenders program. Twenty-four students participated. As shown on pre/post testing, 79 percent of the students reported having gained new information that helped their understanding of how life choices can affect their chances of HIV/AIDS and STI infections.

### *Nutrition Education for Adults*

**Quality of life for the aging population**. The segment of the population ages 65 and over is growing at a rapid rate, increasing the demand for qualified professionals to direct both clinical and community programs related to nutrition and health. The Department of Human Nutrition, Foods, and Exercise (HNFE) has contributed to the preparation of well-trained professionals through credit-based and outreach offerings. HNFE resumed offering a graduate course in nutritional and physiological aspects of aging for future nutrition professionals and exercise physiologists preparing to work with older adults. A statewide workshop for nutrition managers responsible for programs supplying home-delivered or congregate meals to thousands of Virginians provided guidance on maximizing the nutritional quality of their meals. For many program participants this meal is their major source of nutrients. New federal regulations require that all meals funded under the Older Americans Act meet the minimum of one-third of the

Dietary Reference Intakes for older adults. Raising nutrient intake improves the nutritional status of older Virginians, supports independent living, and reduces their risk of disease and disability.

**Dining With Diabetes.** Diabetes has become one of the major chronic diseases in the United States and Virginia. Diabetes can adversely affect an individual's quality of life if the diabetes is not controlled. Dining With Diabetes is a three-session program to help individuals that either have diabetes themselves or cook for someone with diabetes learn to make wise food and food preparation choices. Dining With Diabetes has a lecture component as well as demonstration and taste testing. Twenty individuals participated in the seven-hour course. As shown from a pre and posttest, 85 percent of the participants increased their knowledge about the best foods and food preparation methods to use for someone with diabetes. On average, scores improved from 9.9/13 to 11.5/13. Comments showed that label reading was a particularly helpful lesson. Another participant said "Most helpful info on fats, particularly how they raise and lower cholesterol in the body. I now understand."

### *Physical Activity and Fitness Programs for Adults*

**Steps to Better Health**. According to 2004 CDC data, 20 to 24 percent of Virginia's adult population can be categorized as obese. Being overweight and obese are contributing factors to many chronic diseases. To address this problem, Extension faculty implemented "Steps to Better Health," a 10-week walking and health education program. In Central Virginia, 27 citizens participated in 2005. Evaluations showed that participants increased their level of physical activity and knowledge of healthy dietary practices and made significant changes in their eating habits including reducing portion sizes as a result of their participation in the program. Thirteen of the participants turned in walking logs for a total of 1,858 miles walked during the 10-week period.

**Steps to Healthy Habits**. Diabetes and heart disease are two major health concerns in Virginia. Healthy lifestyle choices can decrease risk for both of these chronic diseases. "Steps to Healthy Habits" is a 10-week mail-out course that helps individuals set diet and exercise goals to help lower their chronic disease risk. Participants choose from one to four goals including increasing water consumption, increasing exercise, eating more whole grains, and increasing consumption of fruits and vegetables. Thirty two percent of the 49 participants completed the evaluation. Of these, 100 percent increased their daily exercise, 100 percent drank more water, 100 percent made a positive change in their diet, and 88 percent have started reading food labels. Comments included "I changed my diet and started to exercise. I lost 12 pounds! My doctor is very happy." Another participant wrote, "Great program! I have lost eight pounds and my blood sugar is much better. My doctor is very pleased. I talked to him about your program. Thanks for your help."

### *Healthy Weights and Fitness in Youth*

**Healthy Weights for Healthy Kids.** Nationwide data show that overweight has increased two to three times among American youth in the past 30 years. Currently, nearly one-third (31.0 percent) of children and adolescents are at risk for overweight or overweight with 16 percent considered overweight. Children who are overweight are more likely to suffer from high blood pressure, high cholesterol, Type 2 diabetes, asthma, sleep problems, as well as lower self-esteem. Healthy Weights for Healthy Kids (HWHK) was developed to provide Extension educators with

a hands-on and user-friendly curriculum to prevent overweight. During 2005 the program reached over 3,000 youth from the Family and Consumer Sciences program area, over 3,000 youth from the 4-H program area, and almost 7,000 youth from the Smart Choices Nutrition Education Program (SCNEP). In 2005, a study was conducted with 311 youth participants of the SCNEP program using the HWHK program. The results showed statistically significant increases in health knowledge, attitude, and behavior scores for most students. Improvements in health attitudes and behaviors were modest, however. Experiential-based lessons were found to be useful for delivering health lessons in nutrition, physical activity, and body image. The model of experiential learning used in this study was mostly appropriate for fourth and fifth graders.

**Beverage Vending Purchasing Patterns and Attitudes in Southwest Virginia High School Students**. Schools reach greater than 95 percent of children between the ages of five and 17 and therefore play an important role in modeling and reinforcing healthy dietary habits among youth. There has been increasing national attention on the school environment and school policies related to food and nutrition, however, few studies have formally investigated the impact of systemic changes in the school on overall dietary habits. In 2005, a study was conducted to investigate the impact of a school-wide policy change resulting in the replacement of sweetened beverages in vending machines with 100 percent juice and bottled water. Questionnaires were administered to high school students prior to the change, as well as immediately following and six months later. Analysis revealed students held attitudes that they were significantly more likely to choose healthier beverage vending options after one year compared to baseline (P=.009). Although vending sales initially declined as a result of the beverage vending change, purchases increased somewhat above original sales at time period three. Additional analysis revealed no significant (p=0.05) changes in purchase patterns. This suggests that students purchase what is convenient and available, regardless of choices. Students also indicated that the top reasons for snack/beverage choices were hunger, taste, and price.

***Expanded Food and Nutrition Education Program (EFNEP)***

**EFNEP**. Obesity and chronic diseases are a serious health crisis in the United States. Paradoxically, people who are experiencing hunger often experience obesity issues as well. This implies that food items hungry people consume are not necessarily nutritious and health sustaining. To complicate the problem further, poor people suffer disproportionately from chronic diseases and obesity which compromises their ability to work, attend school, retain jobs, and manage their lives successfully. The EFNEP works with young families and their children to educate them about good nutrition practices, on how to prepare nutrient dense foods, and on how to keep from running out of food toward the end of the month. A 1996 study showed that for every dollar spent on nutrition education, $10.64 was saved in health care costs. During the reporting year, 3,428 adults participated in developmental nutrition lessons (6 to 10 lessons) and changed their behavior in the following ways: 1) 85 percent showed improvement in one or more nutrition practices, 2) 80 percent showed improvement in one or more food resource-management practices, and 3) 70 percent showed acceptable food safety practices after participation. In addition, 8,033 youth participated in a minimum of six developmental lessons during the reporting year. Pre-post evaluations indicated impacts: 1) 74 percent of 2,989 youth from 127 groups now eat a variety of foods, 2) 77 percent of 2,989 youth from 127 groups increased knowledge of the essentials of human nutrition, and 3) 66 percent of 2,989 youth from 127 groups increased their ability to select low-cost, nutritious foods.

***Smart Choices Food and Nutrition Education Program (SCNEP)***

**The Food Stamp Nutrition Education Program (FSNE).** Limited income people suffer disproportionately from poor health. This program works with people whose incomes are at 130 percent of the poverty guidelines and/or receive food stamps. Nutrition practices are directly related to health. This program teaches people good nutrition practices, sound food safety behaviors, how to prepare nutrient dense meals and how to prevent running out of food before the end of the month. During the reporting year 6,005 adults in Virginia participated in developmental nutrition lessons (6-10 developmental FSNE lessons) and changed behavior in: 1) 87% of Virginia participants had acceptable dietary quality/nutrition practices, 2) 56% of Virginia participants had acceptable practices in food shopping, and 3) 85% of Virginia participants had acceptable food safety practices. In addition, 9,938 youth participated in a minimum of six nutrition education lessons. Pre/post evaluations showed impacts in: 1) 77% of 709 youth from 31 groups now eat a variety of foods, 2) 74% of 709 youth from 31 groups increased knowledge of the essentials of human nutrition, and 3) 64% of 709 youth from 31 groups increased their ability to select low-cost, nutrition foods.

**Kids Cafe Camp.** In collaboration with the Capital Area Food Bank, the Smart Choices Nutrition Education program raised $8,000 from private donors to send 26 impoverished children from public housing developments in Virginia, Washington, DC to a five-day camping experience at the Northern Virginia 4-H Educational Center. The camp was centered on nutrition, health and wellness.

**Childhood Obesity.** Childhood obesity is now a national epidemic with approximately 16 percent of children being overweight or obese. Impoverished children suffer significantly higher rates of overweight/obesity than do other children, specifically due to lack of health care and poor nutrition habits. Twenty-six children who attended an educational program on obesity have a better understanding of: 1) the importance of eating a variety of foods; 2) the essentials of human nutrition, for example, how sugar works in the body, the importance of not including too many foods with high fat content in their diet, and the importance of consuming five fruits and vegetables each day; and 3) how to select nutritious, low-cost foods due to the nutrition lessons.

## Funding and FTE's

Extension Funding

| Year | Federal | State | Local | Other |
|---|---|---|---|---|
| 2000 | $1,654,126 | $4,621,834 | $829,845 | $701,854 |
| 2001 | $1,703,750 | $4,760,489 | $854,740 | $722,910 |
| 2002 | $1,754,863 | $4,903,304 | $880,382 | $744,597 |
| 2003 | $1,807,509 | $5,050,403 | $906,793 | $766,935 |
| 2004 | $1,861,734 | $5,201,915 | $933,997 | $789,943 |
| 2005 | $1,917,586 | $5,357,972 | $962,017 | $813,641 |

Research Funding

| Year | Federal | State | Local | Other |
|---|---|---|---|---|
| 2000 | $222,000 | $405,000 | $0 | $150,000 |
| 2001 | $229,000 | $418,000 | $0 | $154,000 |
| 2002 | $236,000 | $430,000 | $0 | $159,000 |
| 2003 | $243,000 | $443,000 | $0 | $163,000 |
| 2004 | $250,000 | $456,000 | $0 | $168,000 |
| 2005 | $257,000 | $470,000 | $0 | $173,000 |

Extension FTE's

| Year | Professional | | | Paraprofessional | | |
|---|---|---|---|---|---|---|
| | 1862 | 1890 | Other | 1862 | 1890 | Other |
| 2000 | 26.3 | 0.4 | 0.0 | 52.1 | 0.0 | 0.0 |
| 2001 | 21.0 | 0.6 | 0.0 | 85.0 | 0.0 | 0.0 |
| 2002 | 17.5 | 0.85 | 0.0 | 75.0 | 0.0 | 0.0 |
| 2003 | 16.2 | 1.0 | 0.0 | 98.2 | 0.0 | 0.0 |
| 2004 | 26.3 | 0.4 | 0.0 | 52.1 | 0.0 | 0.0 |
| 2005 | 34.3 | 0.4 | 0.0 | 52.1 | 0.0 | 0.0 |

Research SY's Only

| Year | 1862 | 1890 | Other |
|---|---|---|---|
| 2000 | 2.1 | 0.0 | 0.0 |
| 2001 | 2.1 | 0.0 | 0.0 |
| 2002 | 2.1 | 0.0 | 0.0 |
| 2003 | 2.1 | 0.0 | 0.0 |
| 2004 | 2.1 | 0.0 | 0.0 |
| 2005 | 2.1 | 0.0 | 0.0 |

## Goal 4: To achieve greater harmony between agriculture and the environment

Agriculture's long-term vitality and prosperity depends on its ability to co-exist with the natural environment. This involves a blending of environmental, social, and economic opportunities that strive to meet the needs of the present without compromising the ability of future generations to meet their own needs.

The quality and quantity of Virginia's water resources and the sustainability of agriculture and forestry are heavily influenced by the nature of land use by local, state, and federal policies, and by the actions of people who live, work, and visit agricultural and natural resources. One of the most crucial components determining the success of water quality management and protecting natural resources is education.

Too much of an agricultural input in the wrong place can cause water quality degradation or other environmental problems. Management practices and systems have been developed that can sustain yields while protecting the natural resources that produce them.

Virginia Cooperative Extension educational programs on the conservation, protection, and stewardship of Virginia's land and water resources were conducted by Extension Specialists at Virginia Tech and Virginia State University, and by Extension Agents in 107 county and city offices. The Extension efforts depend on the basic and applied research which provides the answers to agricultural and environmental questions. Water quality educational programs concentrate primarily on non-point source pollution and contamination in agricultural and residential environments

Many different strategies and applications of new technologies are necessary to accomplish the overall goal of achieving greater harmony between agricultural and forestry operations and the environment.

Work includes efforts to provide research and education related to farm and forest land protection strategies, reduction of nutrient loading, integrated pest management, reduced tillage, minimized pesticide use, and pesticide recycling and disposal.

Integrated Pest Management systems assure the most efficient pest management solutions and engage one or more complimentary methods to eliminate or reduce pest pressure. Research and Extension efforts have provided cost effective recommendations for the safe and effective control of important plant diseases, weeds, and insects.

Extension and research efforts also developed strategic educational programs that foster innovative and sustainable agricultural enterprises which support opportunities for regional food production, the development of organic and niche crops, as well as high value but low input enterprises.

Every year new growers consider natural and organic production methods. Education and research efforts in Virginia included pasture based beef, no-till and organic vegetables, and organic dairy production.

Major emphasis in recent years has been placed on teaching and encouraging farmers to utilize wastes as fertilizer. As profit margins narrow, there is a need to develop cost effective treatment and handling alternatives that convert wastes into profitable by-products. The management of wastes from intensive animal production and crop processing facilities will continue to play an important role in advancing greater harmony between agricultural and forestry operations and the environment. Research and education focused on effective methods for utilizing crop and animal wastes and adding extra value as sources of nutrients, bio-energy, and other revenue generating by-products.

A key principle of sustainability is recycling renewable resources and minimizing the use of nonrenewable resources. Recycling of organic wastes onto soils improve chemical, physical and biological properties, which increase soil productivity and enhance environmental quality.

Research and Extension outputs generated as part of this goal included: 81 refereed journal articles, six books and book chapters, 75 numbered Extension publications, nine Extension bulletins, 15 theses and dissertations, and 77 other reports.

This section highlights the 2005 accomplishments of Virginia State University and Virginia Tech in achieving a greater harmony between agriculture and the environment. Six theme areas are included in Goal 4:

- Integrated Pest Management
- Natural Resources Management
- Nutrient Management
- Soil Quality
- Sustainable Agriculture
- Water Quality

## *Key Themes*

### *Integrated Pest Management*

**Disposal of Unwanted Pesticides.** The disposal of canceled, banned, or unwanted agricultural and commercial pesticides poses a significant challenge to agricultural producers and other pesticide users due to its high cost. The proper disposal of waste pesticides eliminates a potential threat to health and the environment. In 2005, 87,526 pounds of canceled, banned, or unwanted agricultural and commercial pesticides were collected and subsequently destroyed from 16 Virginia counties. Virginia's Pesticide Disposal Program is a cooperative effort with the Virginia Department of Agriculture and Consumer Services, the Virginia Pesticide Control Board, and Virginia Cooperative Extension. The program assists agricultural producers, pesticide dealers, and pest control firms with the proper disposal of unwanted agricultural and commercial pesticides and is available at no cost to participants. With Extension's assistance and local coordination in the counties and cities, the Virginia Pesticide Disposal Program has collected and destroyed a total of 1,245,851 pounds of pesticides since its inception.

**Pesticide Safety Education.** One of the main roles of the Virginia Tech Pesticide Programs (VTPP) unit is to develop pesticide safety education resources for VCE ANR agents. New materials and information are delivered to agents at an annual Pesticide Safety Educators' Workshop (PSEW). In addition, electronic communication and postings on an agent-only website allows VTPP faculty to add materials during the year, and agents can access these resources at any time. Course evaluation data indicate that agents benefit from attending this program, use what they acquire there, and adopt new practices, lessons, and teaching techniques as a result. In 2005, 80 percent of the agents who completed a course evaluation form at PSEW indicated that in-service will affect the way they teach pesticide safety education courses, and 81 percent of the respondents described a specific practice change. In calendar year 2004, 2,890 certified Private Applicators attended recertification programs sponsored by VCE agents (VCE agents also sponsor or support many of the recertification courses attended by thousands of commercial applicators in the Commonwealth.). Recertification programs enable these producers to continue to purchase and use restricted-use pesticides to protect their crops. They allow other

people who use pesticides “on the job” in Virginia to earn a living -- and do so legally. In addition, high-quality pesticide safety education programs offered to people who use pesticides for a living safeguard both human and environmental health.

**Course/Credit Assignments for Private Applicator Recertification Programs.** The Virginia Department of Agriculture and Consumer Services (VDACS) has primary responsibility for pesticide applicator certification and training in the Commonwealth of Virginia. Virginia Cooperative Extension provides most of the pesticide safety education programs for Private Applicators (growers) in the state. VDACS delegated the responsibility for reviewing and assigning credits to recertification programs for certified agricultural producers to Virginia Tech Pesticide Programs. This arrangement streamlines the approval process for VCE ANR course sponsors because VTPP is familiar with and, in many cases, developed or acquired the materials and methods they use. This in turn simplifies recordkeeping, shortens turn-around time, and enables VCE ANR agents to submit course descriptions by a variety of methods (including on-line).

**Pesticide Safety Education On-Line Courses**. As a result of the development of an on-line course in pesticide records inspection, over 400 federal pesticide regulatory inspectors are better prepared to inspect farms and pesticide application sites. Pesticide regulatory inspectors from across the United States participated in the course, which provided them with an opportunity to improve their skills. Improving their skills improved their ability to protect the environment and public health from pesticide misuse.

**Commercial Pesticide Recertification Conference.** One hundred thirty-seven certified pesticide applicators in the Northern Virginia area were trained and recertified. The recertification covered topics such as changes in pesticide regulations and laws, new pesticide formulations, personal protective equipment needs, backpack calibration, forest, right of way aquatic pest identification and best management practices. As a result of the recertification, attendees reported the following: 97.1 percent gained new knowledge allowing them to make safe and informed decisions about pesticide use, 95 percent agreed the class was a good review of information they needed to know about pesticides and pesticide use, and 90 percent learned things that would save them from legal or regulatory action.

**Pesticide Safety and Integrated Pest Management.** In November 2005, northern district horticulture agents held a prep class for future category 3A and 3B commercial pesticide applicators. This program sought to help future applicators become better prepared to take the certifying test as well as give them beneficial information for responsible pesticide applications. Fifty-one people attended the sessions and 94 percent of surveyed participants stated that they improved their knowledge in recognition, identification, and methods of control of insects, diseases, and weeds.

**Pesticide Use on 20,663 Acres Impacted**. In order to protect the public, the environment, and the applicator, all occupational users of pesticides in Virginia must be certified. To maintain certification, pesticide applicators must attend state-approved training in safe and effective pesticide use every two years. One hundred and seventy-seven pesticide applicators attended a private and commercial pesticide applicator recertification session in Henrico. Surveys showed that these individuals were responsible for pesticide use decisions on 20,663 acres of

commercial, residential, and public lawns and landscapes in central Virginia. Ninety-eight percent indicated that they would improve the way they used pesticides or protected themselves from them as a result of attending the session. The innovative session received first-place recognition in the 2005 Outstanding Pesticide Applicator Recertification Program sponsored by the Virginia Pesticide Control Board.

**Virginia Alfalfa IPM Source Website**. The Virginia Alfalfa IPM Source website addresses the IPM needs and questions of anyone with an interest in better managing insect pests on alfalfa. The website contains nearly ninety separate pages, in addition to numerous photos and illustrations. Comprehensive sections on identification, life history, feeding injury, scouting techniques, and control methods are devoted to alfalfa weevil and potato leafhopper. As a result, alfalfa pests can be accurately identified and reduce the amount of unnecessary and off label pesticide application.

**Reducing Weed Resistance to Herbicides.** Consolidation of chemical companies, a reduction of commercially available herbicides, and the development of herbicide-resistant crops have enabled multiple applications of herbicide in several given chemical families. An outcome has been selection of weed populations with resistance to herbicides and herbicide families. Increased stewardship for resistance management is necessary if the value of our current herbicides is to be retained. Virginia's research and Extension programs focused on developing weed management programs that utilize herbicide and crop rotations, herbicide mixtures, and rotation of herbicide chemistries. These messages are presented at producer meetings and via an electronic Extension bulletin. Adoption of stewardship practices will have to occur in light of the fact that in excess of 80 percent of our soybean and cotton varieties planted are currently Roundup Ready® and the largest seed corn producer currently states that 100 percent of their corn varieties will soon be Roundup Ready®.

**Managing Resistance to Insecticides.** The tobacco-feeding form of the green peach aphid is the most important insect pest of tobacco in Virginia, frequently reducing the yield of untreated tobacco by more than 25 percent. As a group, green peach aphids have developed resistance to more insecticides than any other species of insect. It is important to determine whether the tobacco-feeding form of this aphid is developing resistance to the insecticide Admire (imidacloprid), a neonicotinoid. Admire has provided effective control of aphids on tobacco since 1996 and it is now used on over 80 percent of the tobacco acreage in Virginia. The three insecticides that are the most effective alternatives to Admire for aphid control on tobacco may be taken off the tobacco market in the near future. The loss of these chemicals would increase our reliance on Admire and other neonicotinoids and elevate the potential for the aphid to develop resistance to this group of chemicals. Research found more than 60-fold differences in aphid susceptibility to Admire (based on LC50 values) among over 50 aphid colonies collected from Virginia, North Carolina, and Georgia. Although Admire still controls even the most resistant aphids, the great differences in tolerance to Admire indicate that more serious levels of resistance may develop. These findings illustrate the importance of maintaining registrations for acephate and aldicarb for rotation with Admire in a resistance management program for tobacco.

**Dogwood Borers and the Fruit Industry.** Identification of the dogwood borer sex pheromone has provided a highly sensitive monitoring tool for this pest. Use of this pheromone in

commercial apple orchards has revealed that dogwood borer sex pheromone has provided a highly sensitive monitoring tool for this pest. Use of this pheromone in commercial apple orchards has revealed that dogwood borer is much more abundant and widespread than was previously understood, and our data underscore the need for growers to be more aware of this pest, particularly during the early years of establishment of new orchards planted on size-controlling rootstocks. In addition to being more attractive to dogwood borer males than virgin female dogwood borer (based on the numbers of moths captured), the new pheromone blend is much more species-specific (i.e. selective) for dogwood borer, attracting many fewer clearwing moths of other species than did previous formulations. The sensitivity, species-specificity and attractiveness of the new pheromone is critical for developing and evaluating new, behaviorally-based management tactics for dogwood borer such as mass-trapping, attract-and-kill, or mating disruption. Our data on the abundance of this pest and its potential for multiple generations in the apple ecosystem validate exploration of new management approaches, particularly in light of increasing restrictions on the use of the organophosphate pesticides which have been the most effective management tools.

**Phytophthora Alternatives for Nursery and Greenhouse Crops.** The genus Phytophthora includes a group of destructive pathogens which attack a wide range of nursery and greenhouse crops, as well as many food and forest crops. Economic damage to the nation's horticulture industry is estimated to be in the billions of dollars. Spread of these pathogens is largely by motile zoospores through irrigation systems. Current management programs rely largely on the use of fungicides or water chlorination. Our greenhouse and laboratory research has shown a significant reduction in Phytophthora inoculum survival due to increased water pressure and forces associated with spraying under pressure. Our goal is to use this information to develop alternative methods of water decontamination without the use of chemicals in nursery and greenhouse irrigation systems.

**Discovery of Strobilurin Resistance of Grape Downy Mildew in the U.S.** In 2005, researchers discovered that grape downy mildew in Virginia had developed resistance to a very important group of fungicides, the strobilurin or QoI fungicides. There are no previous reports of this type of resistance in this pathogen in North America, but high levels of resistance were found in isolates from 4 out of 5 vineyards tested in eastern Virginia, central Virginia, and western North Carolina. This early discovery will allow growers to switch to different chemistries for downy mildew control, and likely will save the Virginia grape industries significant amounts of money and avert crop damage.

**Reducing Herbicide Use and Costs.** Many farmers expressed interest in reducing corn herbicide costs. The profit margins for farming have become extremely small and farmers were interested in exploring reduced inputs as an option for improving profitability. Extension collected data on the cost of weed control on 36 different farms over the entire Shenandoah Valley (6,351 acres of corn). The results of the survey were distributed to all farm supply stores in the Shenandoah Valley, published in the Virginia State Dairymen monthly magazine and Delmarva Farmer, and presented in several crop production meetings. In addition, Extension conducted several meetings on weed control technologies. As a result of these educational efforts, agents and farm supply representatives in the Southern Shenandoah Valley report that over 50 percent of the corn acreage in Augusta and southern Rockingham county (the area that

the survey results showed had the highest weed control cost) have shifted to using Roundup Ready Corn® in an effort to reduce weed control costs while maintaining acceptable weed control.

**Scouting Reduces Pesticide Costs and Use.** Using local pest forecasts and IPM scouting procedures and thresholds, 60 Westmoreland soybean producers sprayed and protected crop value on 3,500 acres of soybeans and avoided treatment on 12,500 acres of soybeans saving approximately $12.00 per acre on untreated acres ($150,000). One farmer noted an 8-bushel return per acre for treating a field of soybeans netting him approximately $22.00 per acre after treatment cost.

**Insect Pest Management for Efficient Tobacco Production.** Tobacco is an important cash crop in Virginia with a farm value of over $120 million from 30,000 acres in 2004. With elimination of the tobacco program after the 2004 season, tobacco farmers faced less demand for their crop, lower prices, and higher production costs. However, the future for tobacco looks brighter for 2006 and beyond. Insect pests are important challenges to tobacco production. The failure to control aphids and hornworms can lead to more than 25 percent reductions in yield and quality. Farmers have typically used more preventative applications of insecticides than are necessary. During 2004 and 2005, information on tobacco insect pest management was provided to 5,000 tobacco farmers, Extension agents, and agribusiness personnel. The tobacco IPM program in Virginia helped tobacco farmers switch from widespread use of Temik, a highly toxic insecticide-nematicide used for aphid control (60 percent of the acreage in 1996) to Admire, a safer and more effective treatment that is now used on over 80 percent of the flue-cured tobacco crop. Safe and naturally derived insecticides, Tracer (Spinoza) and *Bacillus thuringiensis* are now widely used to control hornworms and budworms, replacing labor-intensive, hand-applied baits, and more toxic insecticides that have greater impact on the environment. As the result of this program, over 90 percent of the flue-cured tobacco farmers use integrated pest management practices including field scouting, economic thresholds, and cultural and natural controls.

**Monitoring Corn Earworm Resistance.** The corn earworm, an important insect pest in Virginia that attacks cotton, soybean, peanut, tomato, and many other crops, has developed resistance to pyrethroid insecticides. Virginia growers depend on these low cost insecticides when corn earworm populations exceed economic thresholds. In cooperation with other mid-Atlantic states, Virginia conducted a resistance monitoring effort to track the level of pyrethroid resistance. A total of 3,602 adult corn earworm moths were captured over the entire growing season and tested for resistance. Results revealed a very low level of resistance. As a result of this educational program, growers were able to maintain the use of pyrethroids as a crop protectant and employ effective and economic insect control programs.

***Natural Resources Management***

**State Forest Tour.** There is an emerging school of thought that planting pine trees at lower densities leads to higher rates of return and shorter rotations. This is a new area, however, and landowners are seeking science-based information on this subject to make informed, long-term decisions. In response, Virginia Cooperative Extension teamed with the Virginia Department of Forestry and Virginia Tech College of Natural Resources to offer two 8.5-hour field tours on the

Appomattox-Buckingham State Forest. Topics focused primarily on loblolly pine spacing considerations and impacts. Forty-one participants attended these educational programs. Upon completion of the programs, participants indicated increased knowledge levels of 69 percent, 87 percent, 95 percent, and 106 percent for four topic areas. One hundred percent of participants indicated that the workshop would help them accomplish their management goals more effectively.

**Managing Small Woodlots.** As Virginia's population has increased, the average acreage of forested parcels has decreased. This represents a unique challenge to the future of Virginia's forest industry. Meeting the diverse needs of small acreage landowners will require the application of concepts from multiple disciplines, such as traditional forestry, urban forestry, landscape architecture, horticulture, low-impact harvesting systems, and others. In April 2005 Virginia Cooperative Extension partnered with representatives from the Virginia Tech College of Natural Resources, Hudson Forest Equipment, the Virginia Tech Department of Horticulture, and four other state agencies to offer a program entitled "Managing Small Woodlots." Eighty-four participants chose from 22 sessions over a two-day period. Upon completion of the program, 100 percent of attendees indicated that the workshop would help them accomplish their management objectives more effectively.

**Loggers and Sustainable Forestry.** Loggers participating in the Sustainable Forestry Initiative have requested training in business management topics. To address this need, Virginia Cooperative Extension and the Virginia Tech Department of Forestry offered a three-hour workshop entitled "Using a Financial Calculator" in Halifax, Virginia. Thirty-seven participants attended this event, documenting a 92 percent increase in knowledge regarding the use of a financial calculator for making basic business management decisions. Eleven participants indicated that they planned to buy and use a financial calculator as a result of attending the program.

**Logger Management Training.** Past Virginia Tech research revealed that loggers lose an average of 20.7 percent of the timber value harvested in southern Appalachian hardwoods due to undercut, overcut, and otherwise improperly merchandizing material in the woods. Loggers specifically requested assistance with log bucking and merchandising. As a result, a six-hour "Log Grading and Merchandising Workshop" was developed. Fifty-five participants recorded an average 41 percent increase in knowledge regarding log grading and merchandising.

**Future Natural Resource Managers.** In Nottoway County, a special wildlife club was developed. Thirty 4-H members learned how to identify animal skins, skulls, and footprints. They learned what wildlife foods are available and about the importance of habitat protection. The educational programs and efforts will develop a continued interest in and appreciation for wildlife and protection of the environment. This program will lead to youth who will practice good stewardship of natural resources as they continue in their adult years.

**Forest Visualization for Natural Resource Professionals: A Communication Tool.** Foresters commonly cite communication barriers when working with clients. Research has demonstrated the effectiveness of forest visualization as a communication tool, yet key informant interviews revealed no practicing foresters in the State of Virginia making use of free visualization software.

The "Forest Visualization for Natural Resource Professionals" hands-on computer workshop trained Virginia's first cadre of visualization-proficient practicing foresters. As a result, ten of the 22 participants thought the visualization tools they gained would help them improve forest sustainability through better communication with clients. Seven concluded the training indicating they would absolutely use this technology. A one-month follow-up with these participants showed that 3 professionals are already actively using this software as a communication tool with landowners, clients, and stakeholders. Additionally, Fort A.P. Hill military grounds is in the process of integrating this technology into their decision support system for forestland management and the Virginia Department of Forestry may integrate these tools in their statewide Forest Inventory and Analysis program.

***Nutrient Management***

**Nutrient Management Recommendations.** The Virginia Tech Soil Testing Laboratory and Virginia Cooperative Extension provided soil test information and customized nutrient recommendations for 45,000 soil samples, representing approximately 500,000 acres. This includes samples from commercial crop production, commercial greenhouse and nursery production, surface mining, golf courses and industrial lawns, home lawns, gardens, fruits and ornamentals, and research.

**Nutrient Use Efficiency Knowledge for Agribusiness.** Efficiency of fertilizer nutrient use requires well-trained and up-to-date Extension agents and agribusiness personnel. Through presentations, Extension publications, and work with the Virginia Crop Production Association, a group of professionals in Virginia that have important skills and up-to-date information on fertilizer use and nutrient management for agronomic crop production has been created. Training of agribusiness personnel insures that they also are providing quality advice to growers. Extension agents and agribusiness personnel affect nutrient-use decisions on over 1 million acres of agronomic crop production, 6 to 8 million acres of forages and pastures, and over 100,000 acres of managed turf.

**Efficient Fertilizer Recommendations for Environmental and Economic Benefits.** Non-point source pollution continues to threaten the Chesapeake Bay and its tributaries. Farmers were encouraged to take soil samples and utilize the pre-sidedress nitrate test when using organic sources of nitrogen. Following are impacts: 622 soil tests were conducted by the Virginia Tech Soil Testing Lab from Essex County during the past year. Twenty pre-sidedress nitrate tests were conducted in-office for 3 corn producers (over 1,000 acres of corn.) Recommendations were made and given to the farmer. In some cases, no additional nitrogen was applied, resulting in less nutrient loadings on the environment and significant savings to the farmer. Fertilizer recommendations were made for over 2,000 acres of corn and 2,000 acres of small grains. In soils testing high for phosphate, no additional phosphate was applied. In many cases, these recommendations resulted in fertilizer costs being reduced by over $10.00 per acre compared to industry standards and less nutrient loadings on the environment.

**Nitrate Testing Benefits Water Quality.** Clean water is a priority issue for our country with particular emphasis here in the east with the Chesapeake Bay draining significant portions of six states. Extension contributes to water improvements through a commitment to soil nitrate testing

on corn land. Farmers often apply manure to this land but do not know if it will be enough to grow a good crop. Without soil nitrate test results they are likely to apply additional nitrogen as insurance. This year, 500 acres of corn in Culpeper County were tested using a quick nitrate test that provided sample results in 24 hours. Adequate nitrate levels were present on all acres tested, allowing farmers to avoid additional nitrogen application, minimizing impacts on water quality and helping reduce production costs.

**The Virginia Phosphorus Index: A Management Tool Based on Risk of Phosphorus Delivery to Surface Waters.** Excess phosphorus (P) in surface waters can lead to eutrophication, outbreaks of toxic pathogens, and overall degradation of water quality. Many agricultural fields in Virginia currently contain high levels of P. Recent research has demonstrated that the potential for P delivery of P to water increases as soil P levels increase. One primary cause of high P soils in Virginia is over application of P to agricultural soils, frequently associated with application of animal manure based on crop nitrogen (N) requirements, which results in P application rates two to five-fold greater than crop P requirements. A team of scientists and engineers from Virginia Tech and Virginia Cooperative Extension developed the Virginia Phosphorus Index (P-Index) to assess the potential for P delivery to receiving waters. The P-Index can be quantified for individual fields to identify strategies to manage the risk of P delivery to surface water. The USDA-Natural Resources Conservation Service in Virginia now includes the P-Index in their practice standard (#590) for nutrient management. Virginia nutrient management regulations (effective 2006) specify use of the P-Index for recommending P application rates based on the risk of P delivery to surface waters.

**Reducing Phosphorus Runoff from Dairy Farms.** Runoff of phosphorus and nitrogen from fertilizer and manure applications to crops may lead to eutrophication of surface water. While research has examined the ability of individual practices to reduce nutrient runoff, there has been less emphasis on comparing cost effectiveness of practices. Researchers compared the effectiveness of three types of nutrient control strategies in achieving a 40 percent reduction in phosphorus runoff on a representative dairy farm: 1) dairy herd nutrient management; 2) crop nutrient management; and 3) sediment and soluble runoff control. Results show that herd nutrient management strategies alone can reduce phosphorus runoff by one-fourth to one-half of the 40 percent reduction goal, without reducing cow numbers and without large changes in crop production. The remainder of the 40 percent reduction goal can be achieved by shifting crop rotations. Animal nutrient control strategies will be an important part of pollution control policies and programs for livestock intensive watersheds using new guidelines.

**Forage Management and Utilization of Poultry Litter.** At the Piedmont Area Forage Conference, 180 participants learned the importance of forage nutrient management planning. The program resulted in 10 forage producers requesting plans from the Virginia Cooperative Extension. The 10 plans covered 1,200 acres of hay and pasture land which was approved for $12,000 of poultry litter cost-share money. As a result, the producers realized a $35,000 savings in commercial fertilizer and increased the safe and effective utilization of poultry litter in the region.

**Nutrient Composition Assessment and Management of Poultry Litter.** A new project entitled "Nutrient Composition Assessment and Management of Poultry Litter" is now underway to identify the forms of nutrients (primarily organic and inorganic forms of nitrogen (N) and phosphorous (P) that originate from poultry manure, which are suspected pollutants of surface and groundwater. By doing so, it will build a database which will serve as a source of information for proper management of poultry manure and its land application. It will generate useful information that can be used by poultry farmers, state regulators, and Extension personnel. A second objective of this project is to examine the potential use of selected native grass species to retain nutrient runoff from poultry amended field plots. It is anticipated that the massive root system of these grasses would make them ideal for utilization in nutrient interception and runoff retention. It was found that poultry litter, when used as recommended, would benefit agricultural crops with low impact on the environment. Use of phosphorus absorbing chemicals -- alum, lime, and iron sulfate -- is recommended for agricultural soils when poultry litter is used as supplemental fertilizer. These agriculture friendly chemicals will precipitate out excess P in poultry litter preventing it from being removed from agricultural land runoff. These science-based results can be used as best management practices to prevent eutrophication of receiving streams, lakes, and reservoirs. Research findings from this study are being developed into BMPs to educate and distribute to poultry producers in Virginia, regionally, and nationally. Three research presentations were presented at regional and national professional meetings in 2005.

**Turf Love Nutrient Management Program.** James City County is the largest municipality in Virginia reliant almost solely on groundwater. Water quality and conservation are critical to the health of the community. James City County enforces water restrictions on citizens during the summer months when residential demand increases up to 100 percent over winter demand due to watering practices for landscape and turf putting a strain on water resources in the county. Non-source pollution from runoff to area waterways is also an environmental concern. The Turf Love Nutrient Management program, funded through the county and administered through the Extension office, is meeting the educational needs as a positive impact on this issue. Through public workshops, demonstrations, and home visits, the program teaches homeowners how to produce healthy turf while reducing the use of fertilizers, pesticides, and excessive irrigation. Over 200 home visits have been conducted this year. Neighborhood programs and community outreach events such as the fair, farmers markets, diversity days and garden series have increased the impact of educational outreach by reaching over 10,000 citizens. The program worked with the underserved populations by targeting new homeowners in moderate-income developments and through Housing Partnerships to teach skills to improve soil quality and turf health resulting in an increase in environmental impact with the added value of increased home values.

**Turf Nutrient Management**. A post survey of participants in the "Central Virginia Lawn Manager Workshop" showed that 72 percent planned to use soil testing for fertilizer and lime use, 69 percent would calibrate application equipment, and 77 percent would further use Extension resources in their business. Overall, 95 percent indicated that they would change at least one practice to help protect water quality.

**SMART Lawns.** Henrico homeowners seeking high quality turf must deal with the challenges of poor soils and unfavorable weather conditions. The advice they receive from the popular media is often irrelevant to local conditions or conflicting. To address this issue, the Henrico Extension

office enrolled 185 citizens in the "SMART Lawns" program during the reporting period. This program teaches residents best management practices for turf that protect water quality. Program impacts were measured through pre- and post-program surveys. These surveys indicated that the majority of participants increased their implementation of seven of eight recommended practices. In addition, the number of participants rating the quality of their turf as good or excellent increased from 17 percent at the beginning of the program to 60 percent at the end.

**Nutrient Management for Homeowners**. The "Great Scapes" lawn program enrolled 274 clients in 2005. Homeowners received consultation visits from Master Gardener Volunteers where turf area was measured and their soil was sampled for testing. As a result, participants in the program received a customized urban nutrient management plan detailing the recommendations from the soil test including how many bags of fertilizer and lime to purchase for each application if necessary. Plans were provided for a total of 2,744,280 square feet or the equivalent of 63 acres of turf in the local watersheds. Master Gardener volunteers gave 913 hours of their time to this project, making 1,319 contacts.

**Urban Nutrient Management Plans.** Urban nutrient management plans were written for 257 homeowners April through December 2004. Homeowners received consultation visits from Master Gardener Volunteers where turf area was measured and soil sampled for testing. A total of 2,526,614 square feet of turf (58 acres) came under nutrient management this quarter in Prince William County. Participants are given a survey to complete at the beginning of the program. Pre-survey highlights justify the need for this program. Overall, 43.8 percent of clients overestimated their turf square footage, 58 percent applied fertilizer at inappropriate times of year, 43 percent are removing grass clippings on a regular basis, and 47 percent are on their own well and septic system. Master Gardeners volunteered a total of 870 hours and made 1,295 contacts.

***Soil Quality***

**New Soil Survey Online in Virginia.** The availability of eight new on-line soil surveys, mapped by Virginia Tech Soil Scientists, represents great progress in filling the gap in soil survey information in the State of Virginia. We have contributed significant soil specific data that has allowed the update of the Virginia Agronomic Land Use Evaluation System (VALUES). This has been made possible by the soil attribute database collected during the mapping phase. The VALUES represents the scientific basis for establishing crop yield potentials for all soils in Virginia (nearly 900 series) and is being utilized by state and federal agencies entrusted to balance and manage the Virginia soil resource to the fullest potential for efficient agricultural production while maintaining highest water quality standards throughout the state.

***Sustainable Agriculture***

**Organic Dairy Farm Development.** As a result of increased interest and demand for organic milk production and a substantial number of grazing herds considering transitioning to organic, Extension agents held educational programs, tours, and communicated with organic certifiers, feed suppliers, milk cooperatives, and veterinarians. Educational efforts aimed at producers, lenders, feed suppliers, and veterinarians resulted in seven dairy farms transitioning to organic

who will begin shipping organic milk in the fall of 2006. A dairyman in Middlebrook, Virginia became the first producer in Augusta County to ship organic milk in October of 2005. This was the result of the team composed of the dairyman, the organic certifier, and Extension.

**Organic Tomato Production.** Reliable research-based information on organic disease control is limited. This has been a major factor limiting expansion of organic tomato production. A replicated research trial to test various bio-fungicides was conducted. As a result of this experiment, organic growers have valid test results and recommendation to make disease control decisions.

***Water Quality***

**Water Cycle and Youth Education.** In Amelia County, the Extension After School program provided water quality education for 40 children ranging from eight to ten years of age. The youth learned how the water cycle works and how pollution can enter the system. The learning activity was related to their own community water system. The children learned the importance of clean water in the food chain and the effects of chemical and contaminants on wildlife. Ninety percent indicated they understood the problems of contaminated water supplies and said they would work to protect clean water.

**Youth Watershed Experiences.** The 2000 Chesapeake Bay Agreement recommends that all youth beginning with the graduating class of 2005 have a series of "meaningful" watershed-related experiences that help them connect to the processes and issues of the Bay. The "meaningful" definition refers to extended learning opportunities that include introductory lessons and post-activity processing of field experiences. A Virginia State University Extension Specialist conducted fifteen youth educational programs involving approximately 2,250 youth (grades 4 – 12) in a total of 77 hours of instruction in a variety of environment and natural resource topics, including watershed structure and function, water quality measures, field study activities and personal stewardship were conducted in 2004. Fifteen similar sessions involving more than 1,250 youth in 52 hours of instruction were conducted in 2005. Programs included Bug Camp, State Envirothon competition, 4-H Natural Resources Weekend, and numerous 4-H Educational Center and school programs. In addition, eleven adult training programs involving 350 educators in a total of 50 hours of instruction were conducted in 2004. Eighteen adult training programs were conducted in 2005 involving 945 teachers, 4-H Agents and Volunteer Leaders in a total of 75 hours of instruction. Random pre/post student testing indicated a 40% – 77% increase in knowledge and understanding of topics presented. Random attitude surveys indicated a 4.2/10 point shift in environmental issue awareness related to watershed protection and personal behavior impacts on water quality. Programs were rated an average of 4.2/5 and many participants requested more in-depth training.

**What Do You Know About Water Quality?** Water resource issues are frequently in the news; however, many people lack a good understanding of water quality indicators or how their actions affect the resource. To address this need, a Virginia State University specialist piloted the *What Do You Know About Water Quality?* CD-ROM curriculum. This is an interactive, PowerPoint program for grade six through adult that challenges individuals' knowledge of basic water quality. The game emphasizes a number of water quality indicators including: dissolved oxygen,

pH, hardness, alkalinity, nitrate, phosphate, turbidity, and others. Pilot testing of the program produced the following results: A presentation to 15 Extension 4-H agents was well received. Evaluations rated the program 4.6/5. A pre/post test survey of program indicated an 83 percent increase in knowledge and understanding of water quality indicators. Release for public dissemination is planned for the spring of 2006. A multimedia educational program entitled *What is Water?* will be released in March 2006.

**Water Quality for Farm Ponds.** Through collaboration with county Extension agents, Virginia State University Extension faculty continued to offer educational programs in water quality for farm pond owners in Virginia. A series of workshops were conducted in 2005 for more than 150 farm pond owners in Southside Virginia. The workshops focused on pond management for recreation, fun, and profit. Water from the farmers' ponds was tested as part of the workshops and follow up visits were conducted to determine water quality. This resulted in 39 test reports being generated for farm pond owners. The reports provided recommendation to improve water quality that would increase pond productivity. Many of these test results were given immediately to clients with recommendations on how to improve water quality. The workshops resulted in about 50 percent of the attendees taking action to improve the water quality of their ponds. The main action taken for improvement was to increase the alkalinity and hardness of the pond allowing it to be more productive for growing fish. Many site visits were conducted to analyze farm ponds for recreational and aquaculture uses. The water quality program resulted in significant improvements in participants' knowledge and skills in farm pond management.

**Water Quality and Waste Management.** Through a cooperative education program conducted by Extension and the Soil and Water District for New Kent and Charles City Counties, 10,300 out of 10,900 acres of small grain planted in 2005 were planted no-till (95 percent). In 2000, less than 70 percent of small grain acreage was planted no-till. A rainfall simulator study conducted on a Charles City farm under a long-term Continuous no-till Cropping System showed a 74 percent reduction in water runoff, 99 percent less sediment loss, 94 percent less nitrogen loss, and 92 percent less phosphorus losses compared to conventional tilled wheat planting. Because of the Continuous no-till Cropping System, both water quality and soil quality are improving along with agriculture profitability.

**Hanover Land Care Steward Program Addresses County Wide Solid Waste Issues.** Hanover County's only public landfill recently closed, forcing the county to pay to truck garbage to a landfill in another county. Working closely with the Department of Public Works and 18 different educational partners, a program was developed using logic modeling and the VCE Master Gardener Land Care Steward curriculum to train advanced Master Gardeners (MGs) to teach citizens on these subjects. The educational programming process was heavily emphasized from the first class and all trainees participated in class projects. Each participant built and maintained a vermicompost bin and collectively the class designed and built several educational displays for the State Fair and for a local garden fair. The MGs have led workshops on composting and vermicomposting. They developed relationships with area homeowners groups and civic associations and are working with all grades of a local elementary school to teach recycling, wise plant choices and care, composting, and vermicomposting in the classroom. This program, just six months old, has garnered attention at the local, state, and national levels. In this short period, contacts and impacts have exceeded our preliminary expectations. In the past three

months, as a direct result of this program, 220 home vermicomposting bins have been started, each able consume the kitchen wastes from an average family thereby reducing or eliminating the kitchen waste from 220 households. The trainees are still highly motivated to continue volunteering and are willing to sustain the program by organizing the next training.

**Best Management Practice Installation.** Non-point source pollution continues to threaten the Chesapeake Bay and its tributaries, and for the first time in several years, the Commonwealth of Virginia provided significant cost-share funds to help farmers install Best Management Practices (BMPs). The use of these BMPs was promoted in Extension newsletters and during meetings and field days. As a result of Virginia Cooperative Extension promoting these BMPs to farmers, the Three Rivers Soil and Water Conservation District received and approved applications to install over 4,000 acres of cover crops in Essex, King and Queen, and King William Counties. The estimated nutrient and sediment reductions are 20,000 pounds of nitrogen, 650 pounds of phosphorus, and 160 tons of sediment after the installation of these cover crops.

**Recognizing Acid Soil Sulfate Risks.** Potentially acid-forming materials containing reactive sulfides underlie much of the Coastal Plain and Fall Zone regions of Virginia at depths ranging from 10 to 50 feet. Exposure of these materials by road building and other construction activities leads to rapid generation of sulfidic acid in the oxidizing soil matrix and associated severe plant growth and water quality problems. Regional occurrence of these materials was mapped in the late 1990s and seminal reports and papers were published from 2002 to 2004. Within the past year, numerous new exposures of acid sulfate materials in the Fredericksburg/Stafford region have validated and confirmed earlier findings of potential risks. In 2005, significant progress was made in educating the public and local politicians on this issue through a series of (1) site visits, (2) a dedicated short-course in November, and (3) a presentation to the Potomac River Roundtable in early January 2006. Several localities are now actively considering adopting mandatory acid sulfate soil risk investigations into their site planning and zoning process.

**Environmental Outreach through Tire Recycling**. Farmers need to be encouraged to recycle used farm products. There is a particular need to recycle used tires to keep them from becoming an environmental and scenic blight. The Tidewater AREC collaborated with the USDA/Peanut Soil and Water Conservation District to host a two-day tire-recycling event for farmers. This event positively impacted the environment by moving three semi-trailer loads of tires from many locations to a plant where they can be made into useful products. Extension worked with the local Soil and Water District to remove over 800 agriculture equipment tires from 16 participants in 2005. This year's collection, as a whole, saved participants over $1,600 in disposal costs and prevented environmental damage.

**Waste Oil Collection**. Virginia Cooperative Extension worked with 22 agriculture producers to recycle 2,800 gallons of used agriculture equipment oil. One participant indicated the program saved him $500.00 that he would have spent to remove contaminated waste oil from his farm. As a result of this project, surface and groundwater supplies on 22 farms were protected from contamination.

**Virginia's Anniversary Gardens.** Patriotically colored red, white, and blue flowers will bloom across the Commonwealth as Virginia citizens and gardeners celebrate the nation's 400$^{th}$

anniversary by displaying colorfully themed gardens and landscapes in an America's Anniversary Garden project. As a result of the development of this environmental education program, Virginia's Governor Tim Kaine planted the first commemorative garden with College of Agriculture and Life Sciences and Virginia Cooperative Extension faculty. Environmental stewardship, sustainable landscapes, and water quality education are the focus and the work is supported by a grant from the Jamestown 2007 Commission with support from the Virginia Federation of Garden Clubs, the Virginia Nursery and Landscape Association, the Virginia Flower Growers Association, the Virginia Society of Landscape Designers, and the Virginia Master Gardeners Association.

**Bridging Scales in Agricultural Watershed Hydrology.** Recent enforcement of Section 303(d) of the 1972 Clean Water Act has resulted in the need for TMDLs for Virginia waters estimated to cost 60 million dollars. This cost is related to intensified monitoring of the hydrology and quality of these surface waters. This project seeks to develop possible alternative approaches to the analysis and extrapolation of hydrological and water quality data related to non-point source pollution in agricultural watersheds. Fractal and multifractal characteristics of daily runoff rate series in four experimental agricultural watersheds (Little River, Georgia; Little Mill Creek, Ohio; Reynolds Creek, Idaho; and Sleepers River, Vermont) and their associated 30 sub-watersheds were determined. Further research is underway to more fully understand the physical significance of these fractal characteristics of the runoff rate series. Watersheds are the natural geographical units used for management of the nation's water resources. However, many of the estimated 22,000 watersheds and 160,000 associated subwatersheds are ungauged, meaning that hydrological data on them are sparse or lacking. This research has produced evidence showing that runoff processes in watersheds are similar across watersheds of different size (scale), and that it may be possible to transfer measurements and analyses in a gauged watershed or sub-watershed to one that is ungauged, or to extrapolate measurements on a sub-watershed to the larger watershed. Huge savings in water management costs would be realized if this possibility were more conclusively demonstrated. For example, in Virginia alone, data collection and analyses needed to complete approximately 650 TMDLs by 2010 are currently estimated to cost over 60 million dollars. Uncovering analytical techniques whereby scale invariant fractal measures can be used to scale observations up or down across or within watersheds could dramatically reduce the data collection requirements and associated costs.

**Chemistry, Bioavailability, and Toxicity of Constituents in Residuals and Residual-Treated Soils.** Concerns exist surrounding the agronomic and environmental sustainability of land application of biosolids. This research examines the beneficial and detrimental effects of constituents in a variety of land-applied biosolids on soil and water quality. The effects of applications of various sources and rates of biosolids subjected to varying treatment processes to disturbed and undisturbed soils on soil carbon reserves, nitrogen and phosphorus availability and transport, and other chemical, physical, and biological properties that are attributes of soil quality are being measured. The availability of, accumulation by, and toxicity to plants of trace elements applied to soils in biosolids decades ago is also being measured to learn the long term effects. Concerns have been expressed by some scientists that the heavy metal binding capacity of the soil will decline after biosolid applications are discontinued and heavy metal binding-organic matter decomposes, at which time the bioavailability of heavy metals from biosolids applied at rates permitted by the USEPA 503 Rule will increase dangerously over time. This study shows

that no such significant increase in the bioavailability of potentially hazardous heavy metals is occurring at this site as organic matter and soil pH have decreased two decades after high application rates of biosolids containing high concentrations of heavy metals.

**Optimizing Organic Amendments for Land Reclamation and Wetland Restoration.** The restoration of soil productivity on mined lands and created wetlands is frequently limited by high soil bulk density and low soil organic matter content. However, no studies are currently available that specify the appropriate rate of organic matter additions or the relative effects of tillage for these systems. This project will evaluate and quantify the effects of organic matter additions and tillage on soil quality and plant growth response on reclaimed mined lands and created wetlands. Results indicate that much lower amounts of organic amendment are required for successful recreation of hydric soil conditions in constructed wetlands than had been commonly assumed by consultants and regulators. Application of our results would cut organic amendment costs at these sites by as much as $2000 per ha. Our combined wetland restoration research results were utilized by the U.S. Army Corps of Engineers Norfolk District and the Virginia Department of Environmental Quality as their primary technical support for the development of wetland soil reconstruction guidance that was published in a joint agency memo in July of 2004. This is the first formal regulatory guidance with respect to wetland soil reconstruction in the US to date. Our work with lime-stabilized biosolids at the Stafford Airport in northern Virginia resulted in a cost savings in excess of $2,000,000 relative to the costs of topsoil return or combined lime plus compost alternatives. Application of our prime farmland reconstruction protocols in central Virginia and North Carolina has the potential to return up to 5,000 ha of prime farmland slated to be mined in the next 15 years to 90% of pre-mining productivity levels. One Virginia mining company has utilized our research to develop a manufactured topsoil business that is projected to gross in excess of $1,000,000 in 2005.

## Funding and FTE's

Extension Funding

| Year | Federal | State | Local | Other |
|---|---|---|---|---|
| 2000 | $1,194,104 | $3,336,471 | $599,060 | $506,663 |
| 2001 | $1,229,927 | $3,436,565 | $617,032 | $521,863 |
| 2002 | $1,266,825 | $3,539,662 | $635,543 | $537,519 |
| 2003 | $1,304,830 | $3,645,852 | $654,609 | $553,645 |
| 2004 | $1,343,975 | $3,755,228 | $674,247 | $570,254 |
| 2005 | $1,384,294 | $3,867,885 | $694,474 | $587,362 |

Research Funding

| Year | Federal | State | Local | Other |
|---|---|---|---|---|
| 2000 | $2,585,000 | $4,072,000 | $0 | $1,458,000 |
| 2001 | $2,650,000 | $4,191,000 | $0 | $1,502,000 |
| 2002 | $2,716,000 | $4,313,000 | $0 | $1,547,000 |
| 2003 | $2,785,000 | $4,439,000 | $0 | $1,593,000 |
| 2004 | $2,856,000 | $4,568,000 | $0 | $1,641,000 |
| 2005 | $2,927,400 | $4,705,040 | $0 | $1,690,230 |

Extension FTE's

| Year | Professional | | | Paraprofessional | | |
|---|---|---|---|---|---|---|
| | 1862 | 1890 | Other | 1862 | 1890 | Other |
| 2000 | 54.8 | 0.6 | 0.0 | 1.6 | 0.1 | 0.0 |
| 2001 | 58.7 | 0.6 | 0.0 | 1.0 | 0.4 | 0.0 |
| 2002 | 50.4 | 0.2 | 0.0 | 1.0 | 0.1 | 0.0 |
| 2003 | 45.1 | 0.2 | 0.0 | 1.0 | 0.1 | 0.0 |
| 2004 | 54.9 | 0.6 | 0.0 | 1.6 | 0.1 | 0.0 |
| 2005 | 69.8 | 0.6 | 0.0 | 1.0 | 0.2 | 0.0 |

Research SY's Only

| Year | 1862 | 1890 | Other |
|---|---|---|---|
| 2000 | 21.1 | 2.11 | 0.0 |
| 2001 | 21.3 | 2.11 | 0.0 |
| 2002 | 21.5 | 2.11 | 0.0 |
| 2003 | 21.7 | 2.11 | 0.0 |
| 2004 | 21.9 | 2.11 | 0.0 |
| 2005 | 22.1 | 2.11 | 0.0 |

## Goal 5: To enhance economic opportunities and the quality of life among families and communities

Virginia Cooperative Extension (VCE) is focused on enhancing economic opportunities and the quality of life among families and communities throughout the Commonwealth of Virginia. Extension agents and specialists at the land grant universities of Virginia Tech and Virginia State worked with adults, children and youth, volunteers, other organizations and groups, and communities to achieve this goal during the reporting year.

The 2005 accomplishments of Virginia Tech and Virginia State Cooperative Extension and research program in enhancing the economic opportunities and the quality of life among families and communities were achieved in key theme areas. The highlights of these theme areas are presented in this summary.

Virginia Cooperative Extension's major program areas of Agriculture and Natural Sciences, Family and Consumer Sciences, 4-H Youth Development, and Community Viability contributed to program achievements. VCE and the Virginia Agricultural Experiment Stations (VAES) are committed to enhancing economic opportunities and the quality of life for Virginia citizens. During the reporting year, farm families, rural and suburban families, and the families of urban populations throughout the state benefited from the research and educational programming provided. Virginia Cooperative Extension reported impacts of programming validate improved

quality of life for these families, as well as the capacity of communities and local government to improve the quality of life for children, youth and adults in respective counties and cities.

Virginia Cooperative Extension's Family and Consumer Sciences (FCS) programs, conducted by FCS Extension agents and specialists, provided informal education that increased knowledge, influenced attitudes, taught skills, and inspired aspirations. Through the adoption and application of these practices, the quality of individuals, family, and community life in Virginia was improved. During the 18-month reporting period (July 1, 2004 through December 31, 2005), FCS faculty brought specialists, agents, and volunteers expertise together to address the needs and priorities facing Virginia's families. FCS programs involved 65,088 extended learners and 5,256 volunteers, contributing 75,421 hours of volunteer time. A total of $2,625,815 of external dollars was contributed to FCS programming.

During the reporting year, Virginia 4-H Extension agents and specialists provided educational programs that reached 198,958 extended learners. The 4-H program efforts were supported and sustained through 20,405 volunteers resulting in over 519,324 hours of time contributed. Educational 4-H programs were delivered in the context of 10 broad subject matter areas including Animal Sciences, Citizenship, Communication and Expressive Arts, Natural Resources and Environmental Education, Leadership and Personal Development, Plants Soils and Entomology, and Science and Technology. External dollars contributed to 4-H programming totaled $2,317,778 with an additional $2,506,098 contributed to the six 4-H educational centers for a combined total of $4,823,876.

Community Viability programming involved 504 volunteers and 1,028 extended learners. A total of 20,194 hours of time were contributed as well as $39,848 external dollars for the reporting cycle. The programming was effective in helping families to improve their lives through alternative entrepreneurship, community improvements, and creative employment for those affected by job losses.

Research and Extension outputs generated as part of this goal included: 13 refereed journal articles, two books and book chapters, 70 numbered Extension publications, four theses and dissertations, and 14 other reports.

This section highlights the 2005 accomplishments of Virginia Tech and Virginia State University in enhancing economic opportunities and the quality of life among families and communities. Thirteen theme areas are presented for Goal 5:

- Aging
- Character/Ethics Education
- Child Care/Dependent Care
- Children, Youth, and Families at Risk
- Communication Skills
- Family Resource Management
- Agricultural Financial Management
- Home Safety
- Jobs/Employment

- Parenting
- Promoting Business Programs
- Supplemental Income Strategies
- Youth Development/4-H

## *Key Themes*

### *Aging*

**Financial Information.** A review of literature by VCE faculty revealed that much of the elderly population is at risk of receiving inadequate financial information. Many economically marginal citizens resort to predatory lenders. Virginia Cooperative Extension assisted an elderly couple that owned their home free and clear to avoid losing it. They had been approached by a predatory home-equity lender who had told them they could get 150 percent of the home's $75,000 appraised value ($112,500) through an equity loan. Had they taken the loan, they would have been locked into a monthly payment schedule ($700) which they could not afford.

An elderly woman on Medicaid had $3,000 of delinquent payday loans. This individual was subsisting on just $750.00 per month in state Medicaid assistance and $100 in additional food stamp assistance. Through Virginia Cooperative Extension, she was introduced to an attorney specializing in consumer and elderly legal issues. Negotiations were made with the lender for the forgiveness of the debts and she was assisted in developing a spending plan for her limited income. The spending plan allowed her to set aside a small sum for personal pleasures apart from keeping up with her bills.

**Nutritional Aspects of Aging.** There is an increasing the demand for qualified professionals to direct both clinical and community programs related to nutrition and health for the aging population (65 and older). VCE's Health, Nutrition, Fitness and Exercise program has contributed to the preparation of well-trained professionals through credit-based and outreach offerings. HNFE resumed offering a graduate course in nutritional and physiological aspects of aging for future nutrition professionals and exercise physiologists preparing to work with older adults. A statewide educational program for nutrition managers responsible for programs supplying home-delivered or congregate meals to thousands of Virginians provided guidance on maximizing the nutritional quality of their meals. For many program participants this meal is their major source of nutrients.

### *Character/Ethics Education*

**CHARACTER COUNTS!$^{SM}$** Trained Extension agents, volunteers, and State 4-H Specialists have focused on facilitating 4-H/CHARACTER COUNTS! programs in over 60 localities across Virginia and the country of Brazil. This effort has resulted in educational programming that involved 43,735 youth during the reporting year. Evaluations continue to show significant positive behavioral changes in all six Pillars of Character by children enrolled in this educational effort. In the 2005 school year, a group of 16 pre-teens conducted character-building exercises and kept journals through the Character Counts! curriculum administered by the 4-H agent and six teen mentors. Two of these pre-teens were on probation for misconduct following suspension

from school. Both pre-teens had an incident-free school term and improved their overall school grades two letter grades to a "C." Another pre-teen stated in the beginning of the sessions that it was "not cool and why did he have to participate" in the rap sessions. This same individual has now led his group in one of the rap sessions and is a regular participant. The major reason for the program's success stems from senior teens being role models for these pre-teens and encouraging them in their community involvement, particularly school academic work.

**CHARACTER COUNTS!$^{SM}$ Impacts Brazilian Schools**. To address violence in schools, CHARACTER COUNTS! training was conducted for 80 faculty from 20 schools in Joinville, Santa Catarina, Brazil through Virginia 4-H and the Partners of the Americas. CHARACTER COUNTS! was implemented in the schools and impacts were reported at the end of the school year. As one student reported, "The arrival of CHARACTER COUNTS! changed the whole class routine. The students' behavior used to be terrible, they would arrive late and they never did their homework. Today, they study hard and even ask their classmates for help. Even their way of dressing and speaking has changed. The number of fights during recess dropped and there is hardly any rubbish on the patio these days." As a result of this success, five 4-H staff members have been invited to Santa Catarina in March 2006, and will be conducting CHARACTER COUNTS! training for approximately 1,400 schools and judges.

***Child Care/Dependent Care***

**Child Care Providers Training.** Research is well documented to suggest a link between high-quality early childhood care and education programs and children's development physically, cognitively, socially, and emotionally. Research also links the educational and professional skill level of childcare providers to improved quality of care for children. Virginia State University offered a series of professional development opportunities to include conferences and workshop/training sessions to over 350 child care providers in topics ranging from child development to what children need to know to start school. The sessions were held during the evenings and on Saturdays to meet the needs of the clients. Participants included family home providers, center care providers, and childcare center directors and owners. A variety of teaching strategies, resources/materials, tool kits, attention to learner needs, and interactive and small group activities are components of the training sessions. Topic area content included understanding normal child development, cultural sensitivity, positive discipline of young children, fighting obesity and diabetes and keeping children healthy, playground safety and injury prevention, the physical arrangement of the child care environment, developing children's cognitive skills, dealing with anger in children and adults, operating a successful center, and the child care center accreditation process. Evaluation items were targeted toward obtaining information on new learning obtained, new ideas and practices learned, and how the participants plan to use the information, ideas, and practices in the child care program. Ninety-four percent of the participants reported that they had obtained new information/learning; 87 percent reported that they would make practice changes as a result of the new ideas, information, and demonstrations presented during the sessions; 81 percent reported specific plans or ways that they planned to institute changes in the child care setting/program. Comments such as "I plan to talk more with the children, and ask questions while they are playing," "I plan to give clearer and simpler instructions saying what I want children to do rather than what I don't want done," and "I will try more to include the shy and delayed child in center activities" were common.

**Crater District Child Care Partnership.** An Extension child development specialist at Virginia State University collaborated with five local Departments of Social Services, Petersburg Health Department, and Petersburg Public Schools Head Start to form a Crater District Child Care Partnership. The Partnership met over a period of six months to plan and develop an annual District Child Care Provider Conference held in November 2005. The conference "Quality Child Care Today--A Better Future Tomorrow" was funded by private grant funds, local businesses, local Departments of Social Services, and Cooperative Extension. The conference was highly successful and attracted 235 childcare providers, exhibitors, vendors, and planning committee members from the Central Virginia area and beyond. Plans are underway for a second conference during 2006.

**Childcare Education.** According to the Children's Defense Fund, a study of childcare costs in the 50 states showed that childcare is one of the biggest expenses that families face in raising children. The national childcare cost averages close to $6,000 per year. In a seven-county region of central Virginia, 211 providers who care for 3,905 children in 11 localities participated in the three-part "Piedmont Early Childhood Education" training. Each of the four-hour sessions focused on providers complying with state licensing standards. On a scale of 1 to 5 (with 5 being the highest), participants rated their knowledge gained from pre-program of 2.9 to post-program of 4.5. A total of 29 volunteers and collaborators contributed 276 hours to the planning, implementation, and evaluation of this training.

**Childcare Training.** The need for parenting education was in the top 10 priority issues identified in the Virginia Situation Analysis for each locality in Planning District 11 (counties of Amelia, Buckingham, Charlotte, Cumberland, Lunenburg, Nottoway, and Prince Edward). In particular, those who serve as foster parents need to be capable of providing a secure, loving, and structured home environment for the children in their care. A total of 34 foster parents participated in one or more of three daylong (4 to 4.5 hour) educational sessions on "Positive Parenting" at DePaul Family Services. Evaluations at the sessions indicated that parents increased their knowledge of how their perceptions influence their parenting styles—4.6 on a scale of 1 to 5, with 5 being the highest; positive communication practices was 4.4; and how to deal positively with conflict was 4.4. Parents listed specific changes they planned to make as a result of their participation including: "Have more family meetings;" "Be sure that I take time to cool off before discussing any conflicts;" "Set rules and talk about rules together;" "Give more choices;" and "Pay attention to communication skills."

***Children, Youth and Families at Risk***

**Alternative Learning Program for Hope and Achievement.** At-risk high school students in Nelson County are empowered to take an active role in their county's future. As part of a year-long Government and Civic Education Program, a club comprised of 25 students in the Alternative Learning Program for Hope and Achievement (ALPHA) program at the high school have taken an interest in the future of their county and recognized that they can play a role in its development. All 25 of the students in this program are considered at risk in that they would have dropped out of school if it were not for ALPHA. They are meeting with county officials, researching issues on the Internet, and writing articles to the newspaper with their concerns. The

attendance and participation in school as well as respective grade-point averages for these students has increased (from 'D' to 'C+') since being involved in this program.

**VT STARS.** A total of 47 youth ages 14 to 19 enrolled in the VT STARS program, (Virginia Tech Summer Training Academy for Rising Students, a developmental program for Virginia's at risk youth). 4-H and Danville-Pittsylvania County Community Service collaborated to help these teens learn how to give oral presentations about bullying and prevention, and helped them serve as mentors for the 6th grade classes of four middle schools. 4-H partnered with this group by providing training in leadership, anti-bullying, oral presentations, volunteer training, and providing adult mentors for the teens involved. Based on the 33 completed 6th grade teacher surveys, this program contributed to a significant decrease in peer pressure decisions and provided positive role models for the 6th graders at the four middle schools.

**Academic Enrichment Program**. A major concern based on community surveys and comments from community leaders and youth organizations were Academic Enrichment Programs. During August through December, In-School Enrichment programs were implemented in one elementary school and one middle school. This program focused on 40 youth in the Elementary Education Acceleration Program in which youth are behind in their grade levels (lower grade level during first semester). By second semester, the objective is to have students in their higher-grade levels. Programs were designed and implemented that improved learning skills in each student. The program offered hands-on activities, lectures, and presentations in collaboration with the teachers' lesson plans. At both schools, positive differences in students' grades and attitudes have increased by 35 percent.

***Communication Skills***

**4-H Presentation Skills.** Young people need oral presentation/public speaking skills as many jobs require employees to prepare and give presentations. Oral presentation skills have been identified by the Virginia Department of Education as being important for children to learn as evidenced by their inclusion in the Standards of Learning. A total of 687 youth in Botetourt County participated in the In-school 4-H Presentation/Speech program by preparing and giving presentations/speeches for a grade. Ninety-six youth were selected to make presentations at the county 4-H Presentation/Speech contest. Evaluations were conducted with the participants and their parents. Forty-nine percent of the youth (336) and 53 parents completed an evaluation. Participants indicated that 60 percent increased their self-confidence; 53 percent learned what is involved in preparing and delivering a presentation; and 62 percent increased their skills/knowledge in the contest area. Additionally, 53 percent of the parents indicated that their children increased their skills/knowledge in the contest area; 60 percent had increased their self-confidence in presenting to groups; and 77 percent had learned what is involved in preparing and delivering a presentation. Eight percent of the parents responding indicated that their children were very comfortable in front of group prior to the program and contest. Forty percent indicated that they were very comfortable after their experience in the program and contest.

**4-H Public Speaking.** The 4-H program of Russell County involved 413 4-H members in 4-H Public Speaking educational programs. Four hundred three members returned an evaluation instrument. Results showed that 82 percent improved their skills in giving directions in a step-

by-step process; 87 percent learned new skills by listening, watching and asking questions of the other presenters; 84 percent reported that it would be easier to prepare and deliver a presentation having participating in 4-H project; and 76 percent stated that they had improved their self confidence by preparing and practicing their presentation for this project. Teachers working with these 4-H'ers have commented that this project helps them address specific Standards of Learning (SOLs) related to communication, oral presentations, giving and receiving directions, research, and writing.

In Bland County, 242 junior 4-H members conducted a presentation during scheduled 4-H club meetings. After completing presentations, each student completed a follow-up evaluation questionnaire: 82 percent of the members said that their self-confidence improved by participating; 89 percent said their knowledge increased after gathering information for their presentation; 74 percent said that their listening skills improved by listening to others' presentations; 85 percent believed that their knowledge had increased from listening to other presentations, and 40 members were chosen to compete at the 4-H Junior Area Contest where 20 members won champion ribbons.

***Family Resource Management***

**Teen Financial Management.** Patrick County 4-H conducted Reality Store educational programming for high school youth. From a total of 142 evaluations received from participants in the Reality Store program, 87 percent demonstrated an increased ability to make sound spending choices, 85 percent showed an increased understanding of how to make school and career decisions, 82 percent were able to list effective ways to plan for emergencies, and 80 percent demonstrated an understanding of how to budget their money.

**Financial Management**. Newport News conducted Personal Financial Management educational programs for 295 families with 585 participants. Fifty percent of the participants reported increased control over their finances; 251 (42 percent) stated they would make practice changes such as tracking expenses and balancing their checkbook. Additionally, 156 families and individuals (26 percent of 585) reported evaluating their spending habits and making positive changes such as limiting unplanned spending, reducing credit card use, and not carrying cash with them.

"Managing Your Money" educational programming reached 114 participants in a five-county area of Northern Virginia. The six-lesson series taught participants to set goals, track spending, stop spending leaks, develop a spending plan, manage credit wisely, and keep records to take charge of their finances. The follow-up evaluation indicated that 94 percent improved their behavior relating to three or more of the recommended practice changes, such as having written financial goals; keeping track of spending; having an emergency fund; having a system for tracking bills; balancing bank accounts; and saving at least 10 percent of gross income; 59 percent indicated that they had made six or more of the practice changes; and, 35 percent of the respondents had improved on nine or more of the 11 indicators.

**Home Ownership.** Shelter is a basic human necessity. To own a home is often referred to as the American Dream. However, many people are unaware of where to begin this odyssey or what to

expect along the way. Then, after purchasing a home, many are not knowledgeable about cost effective ways to maintain them. For the past 14 years, Virginia Cooperative Extension at Virginia State University has been conducting an annual housing conference for potential and existing homeowners. Topics covered include Steps to Homeownership, Credit and Budgeting, Mortgage Financing, Predatory Lending, Wills and Legal Issues, Importance of Insurance, Landlord/Tenant Rights, Fair Housing, Indoor Air Quality, Energy Conservation, and How to Maintain and Enhance the Value of Your Property. In conjunction with the Virginia Housing Development Authority, Virginia Cooperative Extension continued to offer a series of six-hour homeownership classes for people seeking information on purchasing homes. In addition to the topics mentions above, participants learn about loan closing and the roles of realtor and lenders. In 2005, as a direct result of Cooperative Extension's efforts, 71 home education participants purchased homes. Certificates issued for completing home education programs helped participants secure loans totaling approximately $6.4 million. Twelve educational workshops on Home Maintenance and Repair were conducted for approximately 150 consumers, which resulted in a net saving of nearly $7,000. One hundred fifty people participated in the 2005 Southside Virginia Housing Conference. Ninety percent were first time conference attendees. Conference evaluations showed that 91 percent of attendees would start a home improvement repair project. Two attendees purchased homes.

***Agricultural Financial Management***

**Labor Management Practices.** Labor costs account for 25 percent to 40 percent of vegetable, fruit, and tobacco production expenditures. The adverse wage rate (wage paid to seasonal workers) continues to escalate faster than inflation. Virginia Cooperative Extension assisted eleven farms in Central District with labor management issues. The collective payroll of these farms is $1.2 million, and approximately $6,000 in payroll expenses was saved through the adoption of improved labor management practices.

**Mobile Computer Lab.** Virginia State University's mobile computer laboratory provided an excellent opportunity to help producers become more familiar with computers and record-keeping systems. With the help of an Agriculture Outreach agent at Virginia State University, three, 3-hour "Computer Record-Keeping Educational Programs" were held. At the conclusion of this program, all in attendance stated that they had improved their knowledge of computers and would be better able to keep records for tax purposes, financial statements, and enterprise evaluation. They would also like a follow-up course to become more familiar with other programs and changes as they occur.

**Small Farm Technical Assistance.** Virginia State University Extension specialists and agriculture management agents and technicians conducted the small farm technical assistance and outreach program in selected Southside and Southwest Virginia counties. Participants received information, training, and technical assistance in agricultural production, record keeping and analysis, loan application packaging, business management, marketing, financial management, agricultural risk management, and USDA farm programs for small, limited resource, and socially disadvantaged producers in the targeted counties. Direct contacts were made with more than 3,000 individuals during 2005. These contacts involved farm visits, conferences, workshops, group meetings, farm demonstrations, field days, phone calls, direct

mails and other methods. A survey of participants indicated that the majority (over 70 percent) of participating producers are making more informed production, marketing, financial, and business decisions. Recent research to evaluate program impacts found that the program significantly increased net farm income ($4,000 to $12,000+/year) for the average participant. Economic benefits from the program increased with the intensity of producer's participation in the program.

**Dairy Financial Management.** In Page County, a record 29 farms with $16,321,664 in annual farm income, participated in the Virginia Cooperative Extension Dairy Management Institute (DMI.) Farm Credit reports that DMI makes their customers better managers and provides the dairyman with information available nowhere else. DMI participants consistently rate the program as very strong and important and have started asking for more detailed analysis information. On the evaluation, 100 percent of the multi-year participants responded that DMI was useful in managing the dairy operation. In response to the evaluation question of improved financial management, there was a 36 percent increase in skills and knowledge which is even more impressive when nine of 20 respondents rated themselves at four or better because they have been through DMI in at least one prior year.

***Home Safety***

**Mortgage Default Program.** In Prince William County, all clients who participated in our mortgage default program (86 of 86 families) did not lose their home to foreclosure. Additionally, 32.5 percent of clients completing the homeownership program (69 of 212 clients) purchased a home within one year. Over 600 people attended two Home Buying Information Fairs seeking home buying, special loan program information, and personal credit information in a fun, family-oriented environment. Of the 229 exit surveys collected, 75 percent rated the fairs excellent. The remaining 25 percent rated the fairs satisfactory. The program also completed 326 credit reports with credit scores, and had professional counselors working with clients to interpret the report in a private one-on-one area. Of the respondents receiving free credit reports, 96 percent indicated they would be useful in preparing to buy a home. Several commented specifically on the helpfulness of the report interpreters. Ninety-nine percent of respondents agreed the information was useful and the exhibitors and staff were helpful and courteous. The programming efforts reached the minority population as 53 percent of attendees were black and 19 percent were of Hispanic or other minority groups. Over thirty businesses and nonprofits represented all aspects of home buying and contributed sponsorships.

**Southside Virginia Housing Conference.** As a result of the Southside Virginia Housing Conference, 75 percent of the participants indicated that they had changed their way of thinking about housing and related subjects; 80 percent stated their overall housing situation will improve as a result of attending the conference; 60 percent indicated that they will make a monthly spending plan, and 53 percent stated they will get a copy of their credit report and score.

***Jobs/Employment***

Across Virginia, many communities are in trouble. In our cities, economies sputter, social ties weaken, and political power fades. But everywhere, creative local leaders are fighting back, rebuilding the neighborhoods and communities. And they are succeeding by starting with what

they have. In the face of diminished prospects for outside help, they are turning first of all to their neighbors and to the local citizens associations and institutions that lie at the heart of their community.

Educational programming, in what Virginia Cooperative Extension calls "asset-based community development" summarizes successful community-building initiatives in neighborhoods across Virginia. It simple terms, Virginia Cooperative Extension helps community build employment and sustainable opportunities through and with their own assets.

**Communities in Transition.** Many Virginia communities have experienced double digit unemployment for several years and are fighting to recreate their economy. Dislocated workers are eager to develop the skills that will establish themselves as vital employees. As these individuals begin their journey to reemployment, the Virginia Cooperative Extension has partnered with Region 17 One Stop Centers and provided training and information services that focus on the individual and the family. With a mission to assist communities in addressing their needs, the Virginia Cooperative Extension offered a series of workshops. *Communities in Transition,* a series of free workshops for dislocated workers and other community residents, is designed to (see below for program goals -- and the listing of topics for each week)

- Equip dislocated workers with knowledge related to support services, training options, and career/job tools.
- Identify support systems and tools that assist in managing home and personal resources.
- Provide knowledge and skill options to provide families with an understanding of children's issues in stressful situations.

**Families in Transition.** Virginia Cooperative Extension also developed and implemented a Families in Transition team of community agencies. This team was formed when Pilgrims Pride, a major employer in Virginia, announced it would be discontinuing operation of their Virginia A Community Resource Fair was held for the displaced employees and the larger community. Two hundred people attended the fair and received information from potential employers and community agencies. The Families in Transition team involved the Employment Commission, the Adult Learning Center, the Food Bank, the Department of Social Services, the Literacy Coalition, and various other community agencies.

**Tourism.** Since 2003, tourism annually contributes over $15 billion to Virginia's economy and ranks among the top five largest private sector employers. Leaders in rural communities are aware that they must enable residents to capitalize on their regions' natural scenic environment and historical sites to create viable economic opportunities. Many of these communities are not prone to economic development exercises with an emphasis on "smoke stacks" or "shell buildings," rather on economic opportunities based upon the assets of the community. To this end, community workshops were conducted to access interest in this potential employment sector. After identifying those with an interest, Virginia Cooperative Extension provided educational programming on business development and management, and assisted participants to develop partnerships, in order to facilitate economic development clustering for the enterprise.

**Value-Added Food Processor Assistance Program.** Food processors, including home-based and mirco-enterprises in Virginia need guidance on formulation and regulation of their products in order to produce safe and wholesome food products, compliance with state and federal laws.

Food products and processes are analyzed and recommendations for formulation and processing are delivered. Since we are recognized as a Process Authority for acidified foods, food processors who receive guidance through this program are able to file required processing documents with the Food and Drug Administration (FDA). In the absence of this guidance, processors of acidified foods could not legally sell their products.

Participating companies and individuals receive education on the following topics:

- Federal, state and local regulations for processed food products
- Appropriate modifications in formula and/or process to be in compliance with regulations or to otherwise improve the safety and wholesomeness of food products
- Filing and maintenance of required documentation.

Through this program in 2005, 269 food products produced by 61 Virginia food businesses were analyzed and recommendations were provided. Of those products tested, 74 had a significant food safety issue that, left uncorrected, may have resulted in unsafe food in the marketplace. Furthermore, 20 products had a significant quality issue that may have resulted in significant economic loss for the processor.

***Parenting***

**Parenting Skills.** The need for parenting skills education was in the top 10 priority Situation Analysis issues identified for each locality in a seven-county region of Central Virginia. Those who serve as foster parents need especially to be capable of providing a secure, loving, and structured home environment for the children in their care. Two day-long (fours hours each) educational sessions conducted by Virginia Cooperative Extension, "Positive Parenting of Teens" was conducted for a total of 18 foster parents and two staff members of DePaul Family Services. Evaluations at both workshops indicated that the parents' increased their knowledge of how their perceptions influence their parenting strategies. On an evaluation rating of 1-5, with 1 being poor; 5 being high, the overall rating was 4.6; positive communication practices (4.8); and how to deal positively with conflict (4.4). Parents listed specific changes they planned to make as a result of their participation in the workshops including: "have more family meetings", "be sure to take time to cool off before discussing any conflicts", "set rules and talk about rules together", and "pay attention to communication skills."

**Children Experiencing Behavioral and/or Academic/School Problems.** The prevalence of adolescent and youth risk factors is a costly matter for families and communities in addition to the negative impacts such behaviors have on establishing and maintaining effective family relationships and school success for youth. Parents need information and education to enhance their skills to support their children's emotional, social, and academic success. Parents also need information and resources to assist them in making informed decisions, and supporting and advocating for the needs of their children. Virginia State University responded to several requests for information and assistance from parents whose children were experiencing behavioral and/or academic/school problems. Twenty-seven parent education sessions (consultations and training) were held to assist parents with issues such as positive management of children, understanding child development, understanding the special education process,

understanding the rights of special needs children, parent advocacy for the special needs child, accessing community resources, managing school problems, school adjustment, dealing with crisis situations with children, making appropriate interventions in the home and school environment to assist children. The sessions included educational materials, role-play, videos, home interventions, behavioral management contracts, and referrals to appropriate community agencies and professionals. Principles of family-centered practice were used and included training resources such as Positive Discipline curriculum, National Network for Child Care, CYFERNET, and specialist publications. All of the parent participants reported a progressive and positive change in the child in the home and school environment (from school reports and parent conferences) and that they are using one or more of the suggested interventions.

**Parenting Program.** According to the latest United States census, children under 18 represent 26 percent of the population in United States households. Concurrently, in the City of Petersburg, 6.45 percent (2,177) of the population is under five, and 25.1 percent (8,469) are under the age of 18. Virginia Cooperative Extension faculty designed a parenting program to strengthen families and increase parenting skills by providing extended learning opportunities. A total of 196 parents were involved to improve their knowledge and skills in parenting. All (196) participants stated that they learned new parenting skills to aid in nurturing. Evaluations indicated that 80 percent of the parents had an increase in knowledge about parenting and had made positive behavioral practice changes. Ninety percent of parents stated they had learned how to use effective discipline techniques instead of physical punishment.

**Living Apart, Parenting Together.** Virginia Cooperative Extension's, "Living Apart, Parenting Together" program is offered to divorced/separated parents with custody issues over their children. The program is designed to fulfill the court's requirement of four hours of parent education related to the affects of divorce/separation on children and how to co-parent. In 2005, 152 parents completed the program in a five-county section of central Virginia. The evaluation results indicate that 85 percent have a better understanding of how to reduce parental conflict; 90 percent reported learning parenting skills and co-parenting techniques; 89 percent showed an increased understanding of their child's emotional needs during the divorce/separation; 91 percent stated that the course increased their awareness of the effects of separation and conflict on children and how and why conflict between parents creates stress on children and encouraged accountability for creating peace instead of stress and conflict; 87 percent reported an increased understanding of why children need and want a healthy and meaningful relationship with both of their parents and how to successfully share in the parenting of their children; 93 percent indicated they received information that will help them recognize when their child is experiencing emotional problems, how and where to seek professional help, support and access to community resources; and 84 percent reported an increased understanding of the importance of providing financial support to their child.

### *Promoting Business Programs*

**Selling Fish in the Sashimi Market.** Virginia Cooperative Extension was involved in helping fishermen and seafood distributors sell in the higher-margin sashimi market. Sashimi fish buyers sometimes pay $5.00 per pound more than conventional markets for fish processed to their specifications. However, since Virginia processors did not know sashimi-processing methods,

they could not sell in that premium market. To help processors and fishermen sell sashimi, VCE designed and conducted an educational program on processing techniques. Experts from the largest United States sashimi distributor were involved as instructors. A chef demonstrated how properly processed fish are turned into sashimi and sushi presentations and participants were involved in tasting his wares. Attendees held teleconferences with a sashimi fisherman and potential buyers. Additionally, attendees practiced the processing techniques on flounder, with supervision by the sashimi experts. This educational seminar was reported in the Virginia Marine Resource Bulletin. After the educational programming, some attendees began selling sashimi fish. A spot check in December 2005 showed seasonal selling of upwards to 1,000 pounds of sashimi grade per week at a premium of $5.25 per pound over conventional markets. This translates into at least $5,000 per week of additional revenue. Payback on the $2,000 workshop was rapid. Others are now expressing interest in learning the techniques, and plans are being made to grow the program for 2006. One distributor reports he is getting 2 to 3 purchase requests a day for sashimi.

**Rural Business Development and Entrepreneurship Program.** Virginia State University's Cooperative Extension conducted the Rural Business Development and Entrepreneurship Program in 2005. The purpose of the program was to teach adult and youth residents in six rural counties in south central Virginia to write small business plans, manage small businesses, and obtain financial resources for written business plans. The purpose of the youth component of the project was to provide exposure to career development and entrepreneurship opportunities, provide educational and technical assistance to develop a business plan, and to assist youth entrepreneurs in acquiring management skills that would assist them in starting, owning, and operating a business. The program was implemented in Lunenburg, Sussex, Brunswick, Nottoway, Prince Edward, and Halifax counties. The 4-H Youth Development Specialist delivered the youth component of the educational program. One hundred three youth received training. Seventy-six youth who attended the training completed business plans.

***Supplemental Income Strategies***

**Alternative Income Opportunities for Woodlot Owners.** Landowners intrinsically value their woods but often do not realize economic value. Selling timber is an option but not a yearly income source unless they have very large acreages under intense management. Most landowners would like to realize some profit from their woodland but are unaware of alternatives to timber harvesting. Together with Virginia State University Program, the Northern District Forestry and Natural Resources program, has designed and delivered a 2-day interactive, hands-on approach to teach landowners about alternative ways to earn income and in general care for their woodlots. In the past two years, "Alternative Income Opportunities for Woodlot Owners," has impacted 186 individuals, representing 9,537 forested acres. Participants learned new ways to use their woods and earn income. As a result of their participation, 91 individuals (48 %) believes they are better able to care for their woodland and 81 (44%) believe they are better able to earn income from their property.

**Beginning Farmers.** A diverse group of new and beginning farmers is appearing on the Virginia agricultural scene. Many are retired professionals who are looking for a simpler life in the country. A number of young, college-educated couples are buying small farms with the intention of generating income from farming to support family living expenses. Some African-American

families are returning to farm on inherited properties as dual careers. Also, several factories have closed their doors in rural Virginia towns leaving displaced workers, some of whom are interested in pursuing farming and agriculture-related careers. These beginning farmers need to acquire skills in production, marketing, and farm business management to enable them to succeed in farming. Virginia State University conducted conferences, local meetings, field demonstrations, and individual consultations by phone, mail, and farm visits to help provide the needed education. The Second Annual Commercial Vegetable Production Field Day was held at Virginia State University in June of 2005. Farmers received instruction in basic production skills such as soil testing, field preparation, farm safety, controlling pests, how to use trickle irrigation, variety selection, planting seeds, correct stage for harvest, finding sources of supplies, etc. A Small Farm Family Conference was held in November 2005 at Virginia State University. Farmers received basic instruction in farm business management such as, developing business plans, pricing for profit, market development, record keeping, labor management, preparing loan applications, financial analysis, and tax management. The Virginia Biological Farming Conference was held in January 2005 in Lynchburg, Virginia, to help beginning farmers understand the marketing opportunities presented by the new National Organic Program (NOP) of USDA. A survey of participating farmers showed that: Over 150 beginning farmers developed business plans for their farming operations and many farmers established trickle irrigation systems. Sixty beginning farmers earned an average net income of $6000 from marketing vegetables. Forty beginning farmers earned an average net income of $8000 from marketing fresh cut flowers. Eighty beginning farmers established naturalized populations of American ginseng and/or goldenseal in their privately owned woodlands. Twenty beginning farmers established commercial production of shiitake mushrooms as a new enterprise. One hundred beginning livestock farmers earned an average net income of $4000 marketing pastured poultry, organic eggs, organic beef, or pastured pork. Twenty beginning farmers were approved for USDA loans. Twenty beginning farmers participated, for the first time, in USDA conservation cost-share programs.

**Fruit Tree Grafting.** Many individual fruit growers are re-establishing family orchards. Most are requesting varieties that are referred to as “antique” and are not available from commercial nurseries. The Lee County Virginia Cooperative Extension agent conducted three grafting educational programs. As a result, 65 fruit tree producers grafted 800 apple/ pear trees. With a 70 percent survival rate, these trees have a value of $11,200. In addition, one producer grows and sells one-year-old trees as a supplemental source of income and another established an 8-acre orchard and sells approximately $5,000 of fruit annually.

**Business Creation.** The unemployment rate in Buchanan County continues to be one of the highest in the state. The county Extension Leadership Council, in the Situation Analysis, has identified unemployment as the top issue facing Buchanan County today. VCE addressed this issue by designing and providing a variety of educational programs, workshops, presentations, and seminars. The programs were designed to address marketing, product development, product pricing, and quality control. After participating in these opportunities, five ongoing businesses increased sales and profits or expanded product offerings, and one has a signed exclusivity contract for production for the State Museum of Virginia. Three new home-based businesses were formed and four additional businesses are in the beginning stages.

*Youth Development/4-H*

**Staff Development.** When this reporting cycle began (July 1, 2004), 27 counties and cities (units) throughout Virginia had no managers to lead the respective 4-H programs. Now, only five units in the Commonwealth have vacancies. With support of the state 4-H staff, a three-part orientation training for new agents was developed and put in place. Following this staff development, the fundamental core competencies needed by 4-H agents to be effective were rated by the participants as follows (scale of 1 to 5 where 1=poor and 5=excellent): Essential Elements of Professional Youth Development, 4.50; Purposeful 4-H Programming, 4.00; 4-H Indicators of Quality, 4.42; History of 4-H Youth Development, 4.27; Youth as Learners, 4.31; 4-H Policies, 4.00; and, 4-H Risk Management, 3.50. Additionally, the short-term outcomes of participation in the training program were rated: Knowledge gained, 4.05; Skills/abilities gained, 3.90; Enthusiasm/motivation gained, 3.75; and confidence in incorporating what was learned into the local 4-H program, 4.15.

**Teen Programming.** Over 500 youth participate in State 4-H Congress each year. The 2005 evaluation results showed that a significant number of delegates indicated that because of their participation in State 4-H Congress, they could (1) identify needs in their community and work to meet those needs, (2) think critically about their future and set goals for their future, (3) have friendships with people who are different from themselves, and (4) choose activities that promote health and well-being. Of the youth who participated in 4-H competitions, 54 percent suggested that being involved in State 4-H Congress helped them in school or other work.

**4-H Camping.** Virginia has one of the largest 4-H camping programs in the nation, and camping is recognized as an important delivery mode for positive youth development. In 2005, approximately 24,000 youth and adults participated in Virginia's 4-H camping program. A random sample (n=840) of Junior 4-H campers was surveyed during the summer of 2005. These campers reported that camp enhanced their life skills in the following areas, "treating people who are different from me with respect," "learning to be responsible for myself by taking care of my personal belongings," "developing positive friendships with caring teenagers and adults," and "learning to be a good citizen by contributing to a group effort and helping others." Virginia 4-H camping research suggests that the development of these life skill outcomes contributes to self-responsibility, leadership, and citizenship behaviors when youth return to their homes and communities.

**Bullying.** Virginia State University's Cooperative Extension/4-H Youth Development Program conducted 12 bullying seminars throughout the state of Virginia to address issues of bullying and relational aggression. Anti-bullying programs were delivered to approximately 405 youth, adults, and college camp staff. The seminars objectives include: a) Defining bullying, determining why individuals bully, and reviewing the common forms of bullying; b) Identifying how female bullying differs from male bullying; c) Defining relational aggression and the reasons it is so damaging to females; d) Determining effective methods to address bullying within a camping environment; e) Discussing techniques and interventions adults can use to identify and stop bullying; f) Using role play scenarios to resolve conflicts that youth face when dealing with one another. The bullying seminars led to bullying strategies being implemented during summer camp programs at 4-H Educational Centers in the state of Virginia. Programs were also

implemented at school systems and non-4-H summer camp programs in Virginia. Program evaluation data indicated that youth, as well as adults working with those youth, learned strategies to deal with bullying which helped them feel more comfortable in dealing with bullying issues. As a result of the bullying training, bullying prevention has become a focus of camp staff training for all college-level staff in 4-H.

**The Reality Store.** Bland County's situational analysis identified career preparation as a priority issue for youth. Programs are needed to provide guidance for youth in making career choices and obtaining personal marketing skills. Bland County 4-H programming for sixth graders was revised to incorporate job skills, career choices, management of money, and interview skills. A reality store simulation was conducted at the end of the school year to help students realize the importance of education in obtaining greater earning power. Of the youth surveyed, 83 percent stated that they never realized how much financial earnings are required to live on your own. One student stated, "Reality store makes me want to go home and hug my parents." 157 students and 20 volunteers participated in the Reality Store. Mount Rogers Youth Services partnered with 4-H to conduct the Reality Store project.

## Funding and FTE's

Extension Funding

| Year | Federal | State | Local | Other |
|---|---|---|---|---|
| 2000 | $3,562,736 | $9,954,717 | $1,787,360 | $1,511,685 |
| 2001 | $3,669,618 | $10,253,359 | $1,840,981 | $1,557,036 |
| 2002 | $3,779,707 | $10,560,960 | $1,896,210 | $1,603,747 |
| 2003 | $3,893,098 | $10,877,789 | $1,953,096 | $1,651,859 |
| 2004 | $4,009,891 | $11,204,123 | $2,011,689 | $1,701,415 |
| 2005 | $4,130,188 | $11,540,247 | $2,072,040 | $1,752,457 |

Research Funding

| Year | Federal | State | Local | Other |
|---|---|---|---|---|
| 2000 | $902,000 | $1,647,000 | $0 | $607,000 |
| 2001 | $929,000 | $1,696,000 | $0 | $626,000 |
| 2002 | $957,000 | $1,747,000 | $0 | $644,000 |
| 2003 | $986,000 | $1,799,000 | $0 | $664,000 |
| 2004 | $1,015,000 | $1,853,000 | $0 | $684,000 |
| 2005 | $1,045,450 | $1,908,590 | $0 | $704,520 |

Extension FTE's

| Year | Professional | | | Paraprofessional | | |
|---|---|---|---|---|---|---|
| | 1862 | 1890 | Other | 1862 | 1890 | Other |
| 2000 | 141.5 | 7.0 | 0.0 | 8.9 | 12.0 | 0.0 |
| 2001 | 136.9 | 4.8 | 0.0 | 30.0 | 12.0 | 0.0 |
| 2002 | 128.4 | 4.7 | 0.0 | 31.0 | 12.0 | 0.0 |
| 2003 | 102.6 | 3.7 | 0.0 | 2.0 | 12.0 | 0.0 |
| 2004 | 141.5 | 7.0 | 0.0 | 8.9 | 12.0 | 0.0 |
| 2005 | 154.5 | 7.0 | 0.0 | 9.5 | 12.0 | 0.0 |

Research SY's Only

| Year | 1862 | 1890 | Other |
|---|---|---|---|
| 2000 | 8.8 | 0.0 | 0.0 |
| 2001 | 8.9 | 0.0 | 0.0 |
| 2002 | 9.0 | 0.0 | 0.0 |
| 2003 | 9.1 | 0.0 | 0.0 |
| 2004 | 9.2 | 0.0 | 0.0 |
| 2005 | 9.3 | 0.0 | 0.0 |

# C. Stakeholder Input Process

The Virginia Agricultural Experiment Station (VAES) conducts research relevant to the needs and priorities of the citizens of the Commonwealth. Programs are established based on the input of advisory committees at each of our thirteen Agricultural Research and Extension Centers (ARECs) distributed across the state. The twelve academic departments within the College of Agriculture and Life Sciences each maintain stakeholder groups and the College has its own advisory committee of producers, commodity groups, and agribusiness leaders that provide important feedback to VAES. VAES provides research-based input to VCE programming through faculty research and Extension specialists and administratively through AREC directors and statewide program leaders.

The formalized means through which Virginia Cooperative Extension (VCE) establishes connectivity with the grassroots of the state is through partnerships known as Extension Leadership Councils (ELCs). At the local level, this partnership represents the diversity of each county and city in which VCE exists as a resource. Representation includes VCE programming areas (4-H/Youth Development, Family and Community Sciences, and Agriculture and Natural Resources), community leaders, and other organized community entities that are natural partners for VCE. Extension staff and Leadership Council members work as equal partners to determine needs, establish program priorities, plan and implement solutions, identity and secure resources, market VCE and its programs, and evaluate and report program results/impacts to program stakeholders.

At the state level, local connectivity is achieved through the Virginia Cooperative Extension Leadership Council (VCELC). The partnership is composed of volunteer leaders representing the 22 planning districts of Virginia, at-large members appointed by the director and administrator, all VCE District Directors, all chairpersons (or designees) of the VCE program leadership councils, (FCS, 4-H, ANR), the VCE Director (Virginia Tech), the VCE Administrator (Virginia State University), designated VCE staff from both Virginia Tech and Virginia State University, the 1862 director of the agricultural experiment stations, the 1890 director of research, and the director of governmental relations at Virginia Tech. Currently, all 107 Extension units in Virginia report having an organized local ELC.

Extension provides an important formalized mechanism by which both Virginia State University and Virginia Tech receive stakeholder input for Extension and research programs. The detailed structure and operational methods of VCE Leadership Councils are already described above.

## Local Government Reports

County and city governments differ as to how they prefer to receive reports on Extension programming efforts in the localities. Some local governments prefer written reports, which are reviewed by the elected governing board members. Others prefer that the agents attend board meetings on some periodic basis. When this occurs, the reports are presented in the public board meeting where the public is invited to attend and comment.

## Situation Analysis

Virginia Cooperative Extension takes pride in the premise that vital programming is based on the issues, problems, and needs of the people. A thorough analysis of the situation provides context for understanding these problems. This is a process of determining what situations exist at local, regional, and state levels, and for determining which problems have become issues of major public concern. Situation analysis provides the foundation and rationale for deciding which problems should receive the time, energy, and resources of VCE.

It is important to involve people in the process of analyzing the situation and identifying issues, problems, and opportunities at all levels of Extension programming: federal, state, and local. The Extension Unit Staff, the local Extension Leadership Council, Extension personnel and community people cooperatively determine what questions should be asked, what data should be collected, how it should be analyzed, and what that information means in context. A variety of people representative of the population are involved in the situation analysis process. Deciding “what should be” or “which is more desirable” of several options involves the consensus of judgments made by individuals.

Both users and non-users of VCE are vital participants in situation analysis. An aggressive effort is required to ensure that all under-served groups and minorities are represented. The determination and prioritizing of issues and problems to be addressed by Extension programs is a cooperative people-oriented process, consistent with the VCE mission. This process is at the heart of problem-focused programming.

The environment surrounding Extension programs is constantly changing. It is critical that Extension educators periodically review the situation and environment, the community in which they live and work, the people who live there, and the problems or barriers to their economic and social well-being. Public perception of relevance is reflected in state agency funding allocations. Decision-makers and the public are focusing sharp attention on the use of public dollars today. They are questioning whether agencies are doing the "right" programming. There is an expectation of both results and accountability for public dollars spent. Mandates associated with public dollars are asking that programs be grounded in needs defined by the community.

Until this year, local-level Virginia Cooperative Extension planning has not benefited from a systematic analysis of demographic, economic, agricultural, health, and other factors affecting clientele and their communities. This past year, each VCE unit conducted a formal situation analysis; the analysis provides a clear factual basis for educational program planning throughout the VCE system.

The purpose was to have all 107 VCE units conduct or update their situation analysis to identify community issues for VCE programming efforts. Reports were submitted by December 2004 and posted to the VCE Intranet for viewing. The reports were then reviewed by the Extension Specialist, Evaluation, and given a score of from 1 to 10, along with substantive comments. The scores and comments were sent to District Directors for review and distribution to units. Reports receiving a score of five or less were asked to be reviewed and re-written. The re-writes were typically the description of the priority issues. Overall, the reports were well written and reflective of priority issues in the units.

Leadership then worked with technology representatives to develop a web-based program to assign keywords to the 1,000+ priority issue statements submitted in the reports. A situation analysis issues identification task force, consisting of the Assistant/Associate Directors for Programs and specialists was formed and met for two days in February 2005 to tag unit issues with keywords for the program. The task force created 69 main keywords and over 100 secondary keywords.

Next, a searchable database of all issues submitted from the unit reports was posted on the VCE Intranet. It allows searching and printing of issues by keywords, units, planning districts, and districts. Training is currently being conducted on how units and specialists work in cooperation to develop and implement research and educational programs based upon identified issues.

Additionally, to secure stakeholder input, Dean Sharron Quisenberry held "listening sessions" with significant groups of individuals representing key stakeholder and agricultural commodity groups that have a relationship in the College of Agriculture and Life Sciences.

Each of the sessions used the same format and concept of the questions—first, a general question about their perception of the College, and second, questions asking for answers as applied specifically to their industries. That meant the answers, particularly about what they thought should be the College priorities, were tied to the groups' reason for being formed and were not general. The questions used were:

1. What are your perceptions of College?
2. What are the issues facing you (or your industry) and your community?
3. Who is addressing those issues?
4. Is there a role for the College in addressing these issues?

During the reporting period the following listening sessions were conducted:

- Young Farmers of Farm Bureau – February 7, 2004
- Poultry Industry– January 11, 2005
- Virginia Tech College of Agriculture and Life Sciences Leadership Council – September 22, 2004
- Grape and Wine Industry– August 31, 2005

# D. Program Review Process

## Review Process for Research

**Division of Agriculture, Virginia State University.** The Division of Agriculture in the School of Agriculture, Science and Technology consists of the Agricultural Research Station (ARS), Cooperative Extension Service (CES), Department of Agriculture (DOA), and International Agricultural Programs (IAP), hereafter referred to as units. The review process governs all proposals developed under the umbrella of the Division.

Purpose - To institutionalize the proposal development and review process for the Division of Agriculture and thus provide a mechanism to strengthen and enhance the University land grant mission.

Submission of Request for Approval to Submit Proposals Form - Any applicant within the Division of Agriculture who desires to submit a proposal for consideration must first complete and submit a Request for Approval to Submit Proposals Form to the appropriate Unit Head for review and approval. The Unit Head relays approved form to the Associate Dean for Agriculture for further review and approval after which it is returned to the applicant via the Unit Head for full proposal development.

Development of Proposal - All appropriate University and funding agencies' policies, procedures and guidelines should be adhered to when developing a proposal. Proposal development and submission deadlines are governed by the following: 1) Review and approval of Request for Approval to Submit Proposal Form takes one working day, 2) Division of Agriculture Proposal Peer Review Committee (described below) takes up to five working days, and 3) University review and approval takes up to five working days.

Review of Full Proposals - A full proposal is submitted by applicant(s) to the Unit Head who in turn transmits it to the Dean for Agriculture for review by the Proposal Peer Review Committee. Upon completion of review and necessary revisions, the proposal is sent through the normal University approval process. The Associate Dean’s Office facilitates this process.

Submission of Proposal to Funding Source - Upon University approval, the proposal is collected and submitted by the applicant to the appropriate funding source.

Peer Proposal Review Committee - This committee is responsible for reviewing grants and proposals taking into account a broad area of consideration including the needs of the state and people of Virginia and the United States, the degree of relevance of the proposal research to the land-grant mission and priorities of the University, the need for initiation of research in new areas, and other matters related to grantsmanship. The committee pays particular attention to scientific and technical merit, opportunities for cooperation in the proposed research with other individuals and units within the University and the Virginia clientele. A Chair who is appointed by the Associate Dean for Agriculture in consultation with the Dean, School of Agriculture, Science and Technology facilitates the work of the committee. Committee members are made up of appropriate faculty members from each unit of the Division and others as necessary. Care is taken in selection of committee members to ensure that they do not review proposals in which they will be the principle or co-investigator or collaborator. The Chair is responsible for coordinating and reporting the review of each application to the Associate Dean for Agriculture.

Functions of the review committee are: 1) to review all proposals for scientific and technical merits, 2) to ensure that all proposals fulfill the land-grant mission and priorities of the University, 3) to ascertain that what is being proposed lies within the full range of expertise and capability of the investigators and the University, not withstanding their official duties, responsibilities, and assignments, and 4) to assist applicants with acceptable proposals in locating outside peer reviewers to further review the proposals, if necessary for substance and overall quality.

**Virginia Agricultural Experiment Station, Virginia Tech.** Research under the Hatch, McIntire-Stennis, and Animal Health and Disease Acts is conducted in three Colleges that constitute the Virginia Agricultural Experiment Station (VAES): 1) College of Agriculture and Life Sciences, 2) College of Forestry and Wildlife Resources, and 4) Virginia-Maryland Regional College of Veterinary Medicine.

One of six VAES Project Review Committees reviews each new VAES project proposal: 1) Agriculture and Forestry Competitiveness - Animals, 2) Agriculture and Forestry Competitiveness - Plants, 3) Human Nutrition, Food, and Health, 4) Environment and Natural Resources, 5) Economic, Social, and Community Resources, and 6) Processes and Products.

These Committees are based upon the USDA Current Research Information System (CRIS) classification system, the Strategic Research Plan of the Experiment Station Committee on Organization and Policy (ESCOP), and the Agricultural Research Extension and Education Reform Act of 1998 (AREERA). This arrangement encompasses the interdisciplinary research of the four Colleges.

The Assistant or Associate VAES Director within each College recommends senior faculty members with competence in the subject area to serve on the Project Review Committees that are relevant to the College's research programs. The Director appoints three core Committee

members, and they serve three-year terms. For each VAES project proposal submitted, the Assistant or Associate VAES Director in the project leader's home College chairs the review. The Chair is responsible for selecting: 1) the appropriate Project Review Committee (which includes the three core members), and 2) two or more ad hoc members who are proficient in the subject covered by the proposed project. These may be chosen from outside the University if recommended by the Department Head.

The Chair distributes copies of the proposal to the appropriate Project Review Committee. If the proposed research involves animals, human subjects, or recombinant DNA, a copy of the proposal and a protocol form is sent to the appropriate University committee. After the prescribed review period, the Chair convenes the Committee, the Project Leader, and the Department Head to review the proposal. The Chair requests reviewers' comments and forwards these to the Project Leader and Department Head prior to the oral review. The oral review may be omitted, at the discretion of the Chair, if a majority of the review forms are checked by the reviewers as "approved with no changes" or "approved with minor changes." If an oral review is not conducted, the Chair provides a written summary of the Review Committee comments to the Project Leader.

Each proposal is evaluated according to the following criteria:

1. Is the proposed research relevant to the goals of the Department and College, the needs of the people the research would serve, and the priorities established by Task Forces, Work Groups, or Commodity Research Committees?
2. Are the objectives and procedures clearly stated?
3. Is the proposed duration realistic for the research that is proposed?
4. Are the appropriate or desirable individuals cooperating on this project?
5. Does the project list impacts to Virginia (and elsewhere) or anticipated economic importance?
6. Does the Project Leader’s vita indicate the level of competence required for doing the proposed research?

The Committee recommends that the proposal be either approved with no changes, approved with minor changes, revised and resubmitted, or rejected.

The Project Leader complies with the recommendations of the Project Review Committee and submits the revised proposal to the Department Head, accompanied by a letter delineating the changes that were made in response to the recommendations of the reviewers and/or a rebuttal for any recommendations which the Project Leader does not accept. The Department Head transmits this to the Chair.

The Chair signs Form AD-416 and transmits the above items to the VAES Associate Director accompanied by a letter listing names of the reviewers and date of the oral review. The letter should also state that all recommendations of the Committee have been incorporated into the final proposal. In the event that all recommendations have been incorporated, the Chair indicates concurrence. For McIntire-Stennis proposals, the Administrative-Technical Representative (A-

TR) must sign Form AD-416, certifying that the proposal complies with the purposes of the McIntire-Stennis Act.

The VAES Director meets with the Chair, the Department Head, and the Project Leader if there are any questions or concerns. When the Project Leader, the Department Head, the Chair of the Project Review Committee, and the Director agree that the proposed project should be accepted, the Director approves it, assigns a project number, and transmits it to CRIS/CSREES/USDA. Forms AD-416, AD-417, and CSREES-662 are transmitted electronically.
After approval by CSREES, the Director sends copies of the AD-416 and AD-417 and any written comments from CSREES to the Chair of the Project Review Committee, the Department Head, and the Project Leader. Copies of these documents, the proposal, the statistician's certification, and all pertinent correspondence are retained in the official project file in the VAES Directors office.

**Manuscript Peer Review, Virginia State University.** Manuscripts once submitted to the Research Director are forwarded for external review. Abstracts are distributed to Virginia State University/Agricultural Research Station community (for information only) with listing of authors as it appears on the manuscripts. If someone feels that his or her name needs to be included in the manuscript, the matter is brought to the attention of the author(s) of the manuscript and the Research Director.

The time frame for external review of manuscripts is set at eight weeks. This time frame starts on the day the manuscript is submitted to the VSU Research Director. This implies that the external reviewer will have to return the edited manuscript within the above specified time frame. In the absence of a response from the selected external reviewer within the set time frame, the author(s) have the option to send the unedited version of the manuscript to the journal of their choice.

**Peer Review Process for Virginia Agricultural Experiment Station Publications, Virginia Tech.** Manuscripts for publication in the Bulletin Series or the Information Series of the Virginia Agricultural Experiment Station receive a peer review administered by the VAES Associate Director. Two peer reviewers, anonymous to the author(s), are selected from Virginia Tech or from outside the University if special expertise is not available locally. The Unit Leader is consulted when outside reviewers are deemed necessary. The VAES Manuscript Review Form is completed by the reviewer and returned to the author by the VAES Associate Director. Acceptance or rejection of the manuscript is decided after due consideration of the reviewers' comments. In the event that all recommendations are not included, then sufficient written rebuttals must be supplied by the author.

At the request of Virginia State and to promote coordination, Virginia Tech reviews manuscripts from Virginia State that eventually are submitted for publication in refereed journals. Two anonymous reviewers at Virginia Tech are selected to review each manuscript.

## Review Process for Extension

The review process for Extension programs covers all programs conducted by Virginia Cooperative Extension (VCE), a joint program of Virginia Tech and Virginia State University.

VCE Program Leadership Teams (PLT) develop Extension programs and review programs on an annual basis and make decisions to maintain, modify, or create new programs to meet the needs identified through external and internal stakeholder input.

VCE addresses a broad range of problems and issues facing citizens of the Commonwealth through focused educational programming. This is accomplished and reported through VCE's web-based Planning and Reporting system, which includes long range goals operationalized by annual program plans and reports. The foundation upon which program plans are built is the identification of strategic issues. This is achieved through situation analysis, which is a process of collaboratively determining what problems exist at local, regional, and state levels, and then deciding which ones have become issues of major public concern. This becomes the background and rationale for deciding which problems and issues can be addressed with VCE time, energy, and human and fiscal resources.

Problems and issues identified through situation analysis are communicated through the system and educational program proposals are developed by interdisciplinary PLT's composed of specialists and agents. These teams are organized around and reflect the breadth and scope of priority problems and issues facing the citizens of the Commonwealth. Program proposals identify programming ideas and support that will be provided to local units by the PLT's. The program proposals developed by PLT's are reviewed by VCE programming leadership. Program proposals that most appropriately reflect and address local problems and issues are selected for implementation.

Once approved, program proposals are distributed to all agent and specialist faculty. Faculty select the appropriate proposals for their situation by providing specific information, including the amount of time they plan to devote to the program. At this point, the program proposals become Educational Programs for VCE. At the end of the year, each local unit and campus faculty member completes an annual accomplishment report documenting program activities, results, and impacts for each program plan to which they have allocated time.

## E. Evaluation of the Success of Multi and Joint Activities

In 2005, an evaluation of Multistate Extension Activities and Integrated Research and Extension Activities was conducted using an on-line survey of research and Extension faculty. The definitions used for these activities were those provided by USDA/CSREES:

**Multistate Extension Activities –** Collaborative efforts that reflect the programs of institutions located in at least two or more states or territories.

**Integrated Research and Extension Activities** – Jointly planned, funded, and interwoven activities between research and Extension. This includes the generation of knowledge and the transfer of information and technology.

In addition to asking for a brief description of the activity/program, respondents were asked: 1) the extent to which the activity/program addressed critical issues of strategic importance identified by stakeholders, 2) the extent to which the activity/program addressed the needs of underserved and underrepresented audiences, and 3) the extent to which expected outcomes and impacts were identified and documented for the activity/program.

Fifty-one individuals responded to the survey, representing 65 different projects and programs in multistate and integrated activities. A summary of responses for the three questions above are provide below.

**Addressing Critical Issues**

Critical issues addressed through multistate Extension and integrated activities were driven by 1) input from various stakeholder groups and 2) some combination of research, Extension, industry, and government agency input and active involvement through regular meetings and groups/boards. Many of these are collaborative in nature, rather than just advisory. Faculty stated that this input is very important in identifying high-priority issues and in shaping research and Extension educational responses.

**Addressing Needs of Underserved and Underrepresented Audiences**

Faculty indicated that their efforts to include input from a broad representation of stakeholder groups enhanced their ability to be inclusive of underserved and underrepresented audiences and their needs. Some projects/programs (14 percent), were specifically designed to address the needs of underserved and underrepresented audiences. In all others, faculty were sensitive to this issue and indicated that their process for developing their projects and programs were open to incorporating input and needs from underserved and underrepresented audiences. In addition, many of the faculty indicated that their projects and programs were developed to address all levels and types of audiences, which would include underserved and underrepresented audiences.

**Documentation of Outcomes and Impacts**

The extent to which projects and programs documented expected outcomes and impacts varied by the nature and maturity of the effort. In some cases, goals and objectives, which included outcomes and impacts, were identified by the stakeholder groups involved in the process. These were monitored throughout the lifecycle of the project or program, typically through annual project and program reviews. Project activities, outputs, outcomes, and impacts were typically documented in annual and periodic reports, journal articles, and publications written about the project or program. Based on an analysis of the reported projects/programs submitted in the survey, 1) 12 percent provided documentation of activities, 2) 23 percent provided documentation of outputs, 3) 17 percent provided documentation of outcomes/impacts, and 4) 37 percent provided documentation of anticipated outcomes/impacts.

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

**Institution** Virginia Polytechnic Institute and State University (Virginia Tech)
**State** Virginia

**Check One:** **X** Multistate Extension Activities
Integrated Activities (Hatch Act Funds)
Integrated Activities (Smith-Lever Funds)

| **Title of Planned Program Activity** | **FY 2000** | **FY 2001** | **FY 2002** | **FY 2003** | **FY 2004** | **FY 2005** |
|---|---|---|---|---|---|---|
| 1) To achieve agricultural production system that is highly competitive in the global economy. | $296,000 | $330,000 | $450,000 | $500,000 | $441,800 | $449,412 |
| 2) To provide a safe and secure food and fiber system | 14,000 | 26,000 | 85,000 | 12,000 | 52,900 | 53,785 |
| 3) To achieve a healthier, more well-nourished population. | 14,000 | | 5,000 | 5,000 | 5,600 | 5,665 |
| 4) To achieve greater harmony (balance) between agriculture production(production activities) and (stewardship and protection of) the environment. | 149,000 | 155,000 | 144,000 | 115,000 | 99,500 | 101,169 |
| 5) To enhance economic opportunities and the quality of life among families and communities. | 9,000 | 10,000 | 15,000 | 67,000 | 123,600 | 125,744 |
| **Total** | $482,000 | $521,000 | $699,000 | $699,000 | $723,400 | $735,775 |

Mark McCann
**Interim Director**

4/12/06
**Date**

**Form CSREES-REPT (2/00)**

***Note: The10% target was met in FY 2005***

# Brief Summaries of Selected Multistate Extension Activities

***Goal 1: To achieve an agricultural production system that is highly competitive in the global economy***

**Understanding Legal and Economic Risk in Long-term Leasing: A Special Case in the Appalachian Christmas Tree Industry**

Christmas tree production by 2,400 growers in a 30-county Appalachian region of Virginia and North Carolina has increased in acreage and importance over the last decade, out-pacing tobacco as the most important crop. One of the major limitations to profitable expansion is lack of knowledge and understanding of legal, financial, and production risk of long-term land leasing agreements. Christmas tree growers require extensive and flexible lease agreements that normally extend for 10 years. The project will develop two Extension publications supplemented with an on-line multimedia tutorial explaining 1) legal issues surrounding the methods used to develop flexible long-term leases, and 2) how to develop fair rental rates based on establishment of a negotiation range using a multi-year budget to detail both landlords' and tenants' fixed and variable costs. A series of eight workshops will be conducted in the region to deliver the information directly to the targeted audience of farmers and landlords.

**Southern IPM Center**

The Southern IPM Center is part of a national IPM Center Network, sponsored by USDA. The Southern IPM Center funds grants and coordinates research and Extension programs (in the Southern Region) that benefit stakeholders through Integrated Pest Management (IPM) and communications with other related programs. One of the key issues that affect stakeholders is the need to communicate the latest pest management needs and regulatory status of pesticides to the public. With the implementation of the Food Quality Protection Act in 1996, agricultural producers have become highly vulnerable to major shifts in the registration status of a large number of critical pest control chemicals. In some cases, chemicals used to maintain a viable IPM program were impacted leaving even alternative non-chemical controls in jeopardy. The state contract network was established to communicate critical issues between stakeholders (producers, regulators, Extension agents and specialists, researchers, associations, and decision-makers). In addition to the state contact program, the Center funds projects to develop crop pest management profiles and pest management strategic plans. The outcomes of these efforts are published on the National IPM Center, Southern IPM Center, and state Virginia Tech Pesticide Programs websites. To date, 27 crop profiles have been published on Virginia's major crops and commodities. These publications identify the major pests and pest controls for each crop. These are the precursor to a more involved pest management strategic plan. A focus group meeting of stakeholders is held to discuss each pest and pest control and identify major research, Extension, and regulatory needs of the stakeholders. This information is published and provided to stakeholders, including EPA. The outcome has been information available to regulators to make sound science and needs-based decisions on pesticide registration. EPA weighs the benefits and potential impacts on the agricultural industry against the risks of leaving a pesticide active ingredient on the market or for a particular use.

**Integrated Pest Management**

Accurate identification of insect pest and beneficial species is essential to practicing IPM. However, proper identification of insect pests continues to challenge growers and agriservice personnel involved in pest management in field crops. Of the 13 Pest Management Strategic Plans completed in the Southern Region, the top research and top education issue highlighted by 90 percent of the stakeholders was scouting and pest identification. In addition, an IPM survey of Virginia corn, soybean, and wheat growers by Herbert et al. (2002) found that many often misidentified insect pests. Inaccurate pest identifications often lead to unnecessary or off-label pesticide applications. Photographs and drawings of insect pests and beneficials are available in numerous books, but they are not specific to the mid-Atlantic region, include many insects not found in this region, and omit some of the major pest species. Likewise, several Internet sites with high-quality photographs exist, but results of the recent Virginia IPM survey show that a very small percent of growers are accessing these sites. Survey respondents were unanimous that it was critical to have hard copy information, in the truck, where many of the daily pest management decisions are made. Extension agents, growers, consultants, and scouts need a durable, pocket-sized, high-quality color insect photo guide that will aid them in making proper identification and improve their pest management capabilities. To address this, a cooperative effort between Cooperative Extension specialists at Virginia Tech, University of Delaware, and University of Maryland, sponsored in part by the Southern (UNITED STATES) Region IPM Center (SRIPMC) and the Virginia Department of Conservation and Recreation, developed an insect identification guide, "Mid-Atlantic Guide To Insect Pests and Beneficials of Corn, Soybean, and Small Grains" (VCE publication 444-360). The guide is specific to the mid-Atlantic region, but with broader utility. Forty pest insects and 10 beneficial species are included in this 10 cm x 15 cm (4 in. x 6 in.) coil-bound and laminated handy reference. Clear, high-resolution full-color photos of the organisms are grouped by commodity, along with keys for easy separation of most commonly misidentified species. To evaluate the guide, a self-addressed, postage-paid survey postcard on its usefulness was developed and distributed with each guide. Survey participants were asked to rate their responses to three questions. To date, 112 postcards have been completed and returned (51 from farmers, 21 from Extension agents, 19 from agriculture industry members, and 21 others). On a scale of 1=not useful to 5=very useful, usefulness of the guide was rated 4.7; effectiveness of the guide in improving ability to identify an insect was rated 4.6; and improving pest management decisions was rated 4.3. These results indicate that the guide has been well-accepted by clientele. It is interesting to note that many respondents indicated that they would like to have access to guides on other commodities (e.g., alfalfa, vegetables) and other pest groups (e.g., weeds). Even with the many websites with insect photos, it is clear that clientele appreciate high-quality, hard-copy pest identification guides.

**Alternative Forages**

Following the droughts of 1998 and 1999, advisors requested that Extension investigate alternative forages that would be more resilient under drought conditions. The year was spent gathering information from universities in the eastern and northeastern United States including the University of Maryland, Penn State, West Virginia, and Cornell. A forage called Smooth Bromegrass appeared to have the characteristics many farmers were requesting. A subsequent survey of area farmers revealed there were only four fields of Smooth Bromegrass in the northern Shenandoah Valley. Information about Smooth Bromegrass was provided to farmers at three meetings, involving 100 people. During these meetings, Smooth Bromegrass was presented

as forage that should be planted on an experimental basis because it was not understood how well it would sustain itself through droughts, pests, and different management. Also, a paper was developed by Extension faculty and a farm supply representative who had experience with Smooth Bromegrass. It was widely distributed at meetings and on the VCE Intranet. During the spring of 2003, an evaluation was made of nine fields (existing and recently planted) of Smooth Bromegrass in the northern Shenandoah Valley. Data collected from these observations indicated that Smooth Bromegrass has more longevity, requires less herbicide, and requires less insecticide than Timothy. Also, both field observations and university variety tests show that Smooth Bromegrass yields are equivalent to Timothy. The net economic benefit is about $20.00 acre per year for those who planted Smooth Bromegrass versus Timothy. In addition to the collaboration described above, an agent from Washington County, Maryland made a presentation at a forage meeting in Virginia's Shenandoah Valley and Extension faculty have had numerous discussions with specialists from West Virginia University about Bromegrass production. As a result of these efforts, eight farmers have planted 255 acres of Smooth Bromegrass. The net economic benefit of these additional acres of Smooth Bromegrass has totaled $8,520.

**Multi-State Development of Small Fruit Production Guide**

In Virginia and other states throughout the Mid-Atlantic region, there is increasing interest in specialty crop production, in particular small fruits such as strawberries, blueberries, and brambles (raspberries and blackberries). There is a significant need for an all-inclusive manual that not only addresses pest management, but also general production in this region of diverse climate and growing conditions. This is an important and timely publication that will be a standard reference for years to come. In 2005, small fruit specialists from states in the Mid-Atlantic region began a collaborative effort to develop a multi-year production and spray guide for small fruit crops. This effort was led by Penn State, and involves faculty from Virginia Tech, University of Maryland, West Virginia University, Rutgers, and the University of Delaware. The publication, known as the Mid-Atlantic Berry Guide, has been completed and will be distributed in early 2006. Demand and sales will be an initial indicator of the importance of this publication. It is anticipated that it will become the standard production reference for growers throughout the region, helping them to make critical decisions on varieties, field production, and pest management. These decisions will ultimately impact farm profitability and help to insure the economic viability of these crop options.

**The Virginia Geospatial Extension Program**

The Virginia Geospatial Extension Program was invited to provide Global Position System (GPS) training through Maryland Cooperative Extension in the spring and summer of 2005. This program was based on Virginia's Extension agent GPS program. Agents representing all of Maryland's Extension offices, as well as most (or all) of their agricultural research centers attended at least one of the three regional workshop sessions in Maryland. Participants were provided with overview presentations of GPS, as well as hands on field-based exercises on the applications of GPS to support the application demands of Maryland Cooperative Extension. A representative from Pennsylvania Cooperative Extension also attended some of the programs. This program provides a more accurate and streamlined process that can support several areas of strategic importance, including: soybean rust identification and monitoring, natural resource management, watershed management, precision agriculture, community planning, public safety, disaster assessments, disaster reporting, disaster management, estimation of fertilizer application

amounts, champion and historic tree registry reporting, hunter educational courses, weed and invasive species scouting and monitoring, and identifying point and non-point pollution sources, etc. Impacts to date have not been established. However, anticipated impacts could include: number of independent farms/households impacted by GPS tools in Maryland as a result of this program.

**The National Geospatial Technology Extension Network**

The National Geospatial Technology Extension Network (NGTEN) Web-Portal is being designed to support the needs of our respective state and national constituent base. In addition, this web-portal is being developed in accordance with Extension protocols to support expandability and to provide the potential leveraging of future resources. The NGTEN Webpage Committee is comprised of geospatial Extension specialists from Virginia, Arizona, Texan, Connecticut, Rhode Island, and Nebraska. The overall mission of the geospatial Extension program is to "raise the tide" of geospatial efforts at state, regional, and local levels, and to support the needs of other organizations, including Cooperative Extension and nonprofit organizations. This activity supports existing efforts in all the geospatial Extension programs to support the needs of the underserved and underrepresented audiences. The geospatial Extension specialists in Nebraska and Arizona, for example, work closely with Native American communities and tribal colleges. This effort continues to be a work in progress, and the web-portal has not been opened up to the public yet. It is anticipated that outputs will include: number of hits on the webpage, number of returning visitors, number of questions and correspondences sent (in the "ask the experts" section), and the number of quality resources posted to the portal.

**Comparisons of Holsteins, Jerseys, and their Reciprocal Crosses for Lifetime Economic Merit**

This project is a long-term breeding trial conducted by Virginia Tech, University of Kentucky, and North Carolina State University. We have bred purebred Holstein and Jersey cows at these three institutions to four Holstein and four Jersey bulls in AI service at Select Sires, producing both pure breeds and the two reciprocal crosses for the study. We monitor a variety of performance characteristics such as birth weights, calf mortality, growth rates, rate of sexual maturity in heifers, productivity, health issues, reproduction, and survival. This is a work in progress, as the oldest animals are just being rebred following first calving and matings are still being made to produce animals for the project. We have reported comparisons of birth weights, dystocia, and calf mortality and immune response measurements in calves at national meetings. Two masters theses have been completed to date. Growth data are accumulating and will be the next results to be shared publicly. Data from the crossbreeding project have been communicated to producers in Virginia as part of the 2005 Area Dairy Management Conferences held in five locations around Virginia. The results presented are pooled from data collected at the cooperating institutions. The principal investigators at each of three institutions have major Extension appointments. Results of this work will have impact on dairy Extension programming in all three states. This project, though over three years old, is still in formative stages. Outcomes are longer term. We have, however, given a tacit approval to the practice of crossbreeding by studying it at major agricultural research institutions. Perhaps our greatest impact to date is the opportunity to discuss crossbreeding with an industry that has not seriously considered it in the recent past. We are beginning to build a body of documented, carefully analyzed, comparisons of

Holstein and Jersey cows, in addition to the question of use of crossbreeding in dairy breeding systems.

***Goal 2: To provide a safe and secure food and fiber system***

**Central Virginia Animal Electronic Identification Program**
A field day highlighting Animal Electronic Identification efforts in Virginia was held in Madison County. Over 625 people attended the event. Part of the field day focused on 100 cows that were tagged with radio frequency identification (RFID) tags and tracked to a processor as part of the Southeastern Livestock animal ID tracking USDA test pilot program. Virginia and Kentucky worked on the project together. An Extension specialist from Kentucky coordinated the project and conducted the demonstration at the field day. Data was also tracked in the same system with over 1,400 feeder calves that were sold in the special state graded feeder calf sale held as part of the field day. The activity demonstrated how animals could be tracked through a livestock market. It also identified challenges that need more research to reduce the failure rate of calves the reader did not record. This will help producers and markets comply with the National Animal Identification Program in the future. Working with Kentucky and eight other states in the Southeast reduces duplication and increases the uniformity between systems in each state.

**Fisheries Extension Enhancement: Training and Education in Support of Controls for Scombroid (Histamine) Poisoning**
This project addressed one of the critical issues for the commercial seafood industry and for federal and state regulatory personnel. Histamine poisoning is one of the three leading causes of seafood illnesses. It is also a high priority for the Food and Drug Administration, who are enforcing histamine control regulations with seafood processors and harvesters. The objectives of the project are to: 1) reduce illnesses in the United States caused by scombroid poisoning; 2) reduce losses of histamine forming food fish from the marketplace caused by onboard mishandling and to minimize the associated economic, regulatory and social consequences of those losses; and, 3) establish a nationally coordinated educational network from academia, agencies, and commercial fishing/charter organizations to improve communication among these groups. Activities to date have included: 1) coordinated program development, implementation and evaluation with representatives from fisheries management organizations and agencies, Sea Grant Programs, health agencies and commercial fishing, processing and charter/headboat organizations; 2) identified and documented histamine control programs in use by the industry; 3) reviewed state and federal inspection reports, and identified practices deemed to be acceptable or unacceptable; 4) developed model histamine control programs for training and web posting; 5) developed a curriculum and set of training materials for commercial fishermen and charter boat operators; and, 6) tested the materials.

**Good Agricultural Practices**
In 2004, a new collaborative grant (USDA Fresh Produce Safety for the Southeast) was received to continue food safety programming through the fresh produce food safety initiative known as GAPs (Good Agricultural Practices). This effort is being lead by North Carolina State University and involves Virginia, South Carolina, Georgia, Tennessee, and Florida. GAPs have been collaboratively developed and implemented by the participating states. This grower and agent centered training addresses microbiology aspects of food safety, pre- and post-harvest GAPs

procedures, product traceback, and record keeping. Recent focus for our program at Virginia Tech has been grower preparation for fee-based, on-farm, GAPs state certification program administered by the Virginia Department of Agriculture and Consumer Services (VDACS), which will substitute for expensive third-party inspections. GAPs have historically been directed toward large, commercial-scale growers. In this new grant project, small-scale growers who retail and market at farmers markets and on-farm pick-your-own or by other means, have been included as target audiences. Though compliance with GAPs is not a law, we recognize that an understanding of reduction of risk in fresh produce is important to growers fitting many different profiles. Effort has also been made to deliver this program to the Hispanic worker audience. These workers are recognized as the primary handlers of fresh produce during harvest and packing, and represent a key risk factor in the farm-to-fork control-point chain. Spanish videos, posters, and other materials have been delivered to this Hispanic worker audience through on-farm trainings conducted by Extension staff and the owner/operators of farms and packing houses. In Virginia, VCE agents have been sent out of state to receive specialized training and have also been trained in state. These agents have in turn trained an additional 25 agents and growers in their geographic regions. Over 400 growers in the state have been introduced to the GAPs concept in one-half to one-hour sessions at winter grower educational meetings and pesticide applicator training sessions. We have also collaborated with VDACS to develop a statewide, affordable, fee-based, on-farm safe produce certification/audit program for farmers. In 2004, we offered agent in-service training on GAPs farm plan development and assistance in preparing growers for farm audits. Growers achieving successful certification will have a significant marketing tool and lessen their liability.

**Virginia/Carolina Agriculture Risk Management Seminar**

The Virginia/Carolina Agriculture Risk Management Seminar was held in Franklin, Virginia. Two peanut processors/shellers, one from Virginia and one from North Carolina, gave presentations regarding peanut contract opportunities. Three Extension research specialists, two from Virginia and one from North Carolina, gave presentations regarding peanut production research. One commodity marketing/farm business management Extension agent from Virginia gave two risk management presentations, one regarding costs of production and one regarding marketing alternatives. Participants included 277 producers (171 from Virginia and 106 from North Carolina), five peanut sheller/processors, 27 lenders, 16 Extension agents, five Extension specialists, and 12 Virginia Department of Agriculture and Consumer Services personnel. Three hundred twenty-nine compact discs containing the 2004 southeast Virginia crop budgets and seminar proceedings were mailed to clients in both Virginia and North Carolina. As a direct result, peanut shellers raised their contract offering from $450.00 per ton to $500.00 per ton. In addition, peanut producers increased planting intentions by 5,000 acres over the previous year. Direct increase in gross economic revenue from additional peanuts was estimated $3,750,000. An additional $2,625,000 was generated from the extra $50.00 on the peanut contract. Total economic impact of the Virginia/North Carolina Risk Management Seminar was estimated to be well over $6,375,000. The economic ripple effect of such an increase in gross sales of peanuts was calculated to be $1,912,000 in additional revenues for vendors and other stakeholders in rural southeast Virginia and northern North Carolina communities. The total economic impact of the seminar was estimated to be $8,287,500.

**Southern Plant Diagnostic Network**

The Plant Disease Clinic is a member of the Southern Plant Diagnostic Network and has procured funds through this organization for improving diagnostic capabilities of the lab and upgrading the database that stores information on plant diseases in the state. Specifically, we were able to introduce new, rapid techniques (Enzyme-linked Immunosorbent Assay) for identifying the exotic pathogens, *Phytophthora ramorum* (cause of the disease, Sudden Oak Death) and *Phakopsora pachyrhizi* (cause of Soybean Rust). We were also able to upgrade our database to a new, web-based version and we have begun the process of integrating the Agricultural Research and Extension Centers into our database system so that we will have electronic records of diseases diagnosed in the whole Commonwealth. Previously, information on diseases of some of the major crops in the Southeast (e.g. soybeans, peanuts, tobacco, and cotton) was not included in the Virginia database. With the new database system, we are able to submit data on Virginia diseases directly to the National Agricultural Pest Information System (NAPIS). This central database will allow epidemiologists to better track and predict the movement of introduced pathogens, whether they are introduced accidentally or intentionally. Information on positive finds of the above pathogens for the state can now be more rapidly communicated to Extension professionals in surrounding states in the Southeast through the Southern Plant Diagnostic Network, which includes Florida, Georgia, Alabama, Mississippi, North and South Carolina, Virginia, Kentucky, and Tennessee. This will allow for a more rapid regional response to introduction of these pathogens.

***Goal 3: To achieve a healthier, more well-nourished population***

**Kids Cafe 4-H Camp**

Children from very impoverished neighborhoods (public housing developments) who are participating in the Kids Cafe Programs are recruited to attend 4-H camp at the 4-H Educational Center in Front Royal, Virginia. The children come from Northern Virginia, Washington, D.C., and Maryland public housing sites. The Kids Cafe program feeds hungry children in an after-school program that is in their own neighborhood. The Second Harvest Food Bank sponsors these programs and centers programming around empowering children to healthier living through nutrition programs, anti-drug, anti-smoking, pregnancy prevention programs, and self-esteem building programs. The Second Harvest recruits the children from their program to attend the 4-H camp during the summer. VCE (Expanded Food Nutrition Education Program and Food Stamp Nutrition Education program) and the Second Harvest Food Bank write grants and solicit private donations throughout the year to sponsor the children. These children would never be able to have this camping experience without their tuition being paid for through sponsorship. The camping experience is a five-day program during one week of the summer. The children participate in six hours of nutrition/wellness programs and the rest of the week is devoted to typical camping activities. Using a pre/post test the children increased their knowledge about eating a variety of foods (36 percent pre-test; 39 percent post-test), the essentials of human nutrition (56 percent pre-test; 56 percent post-test), and selecting food that is low-cost and nutritious (29 percent pre-test; 33 percent post-test).

**Vivir con Diabetes**
The overall goal is to translate the "best practices" of the prevention and control trials related to diabetes prevention into a practical educational intervention (Vivir con Diabetes) for an underserved population, the Hispanic population. This year involved the development of a research proposal to the National Institutes of Health (NIH) and integrated activities among Illinois, Colorado, Washington, and Virginia. No research results were delivered to clientele yet. Ultimately, the project will involve participatory research that allows the local knowledge to guide approaches. The Vivir con Diabetes program and translational research project will include both a peer educator diabetes awareness program and an eight-month train-the-trainer community-based educational intervention. By including four states in Vivir Con Diabetes this research will test the transportability of Vivir con Diabetes and identify barriers and mediators in several environments. The long-term objective of this proposed project is to move translational research forward with a diabetes awareness and education umbrella program, Vivir con Diabetes, that will strengthen the capacity of local/regional/national organizations associated with Extension to reduce the disproportionate burden of diabetes among Hispanic communities.

***Goal 4: To achieve greater harmony between agriculture and the environment***

**Natural Resources Leadership Institute**
Under funding by the Kellogg Foundation, the states of Virginia, North Carolina, Tennessee, and Kentucky developed and conduct parallel yearlong programs on environmental conflict resolution in community settings. To date, 170 Fellows from state and federal agencies, corporate environmental officers, Extension agents, elected officials, environmental advocacy organizations, and community leaders have participated in the Virginia Natural Resources Leadership Institute (VNRLI). The vision for VNRLI is to create a leadership network of Virginia's natural resource managers encompassing all sectors (public, private, community, nonprofit), provide these leaders with the leadership skills needed to build consensus around environmental issues to move beyond conflict to find creative solutions (leadership development will be based on the model of "leaders as principled conveners, facilitators, and stakeholders"), and improve the capacity of Virginia's communities to engage in productive dialogue and resolution of natural resource issues important to community sustainability and, thus, improve the management of Virginia's natural resources. Specific examples of impacts by the Fellows include: 1) One graduate chaired a logger training and education council, and used large group facilitation techniques to achieve reciprocal agreements with representatives of eight states. Consensus was reached, making it easier for certified loggers to work in border states. 2) One graduate chaired a Sustainable Initiative Committee on developing a process for reporting inconsistent forestry practices, and used small group facilitation techniques to achieve consensus on a Standard Operating Practice (SOP) for member companies involved in this program. 3) One graduate began a Smart Growth Roundtable in south Hampton Roads to develop proactive guidelines and principles for the region. 4) One graduate assisted an historic church in Fredericksburg in planning how to involve its neighbors, city, and members in meeting its new space needs with the constraints of the property available. 5) One graduate addressed a Planning Commission in a rural Virginia County about a bypass they were proposing through the historic downtown area. As a result, the Planning Commission tabled the bypass to assemble a Citizen's Land Use Committee and a Citizen's Planning Academy. 6) One graduate prepared for a facilitation role in a conflict between a community and an oil refinery in Louisiana.

**Management of Wildlife Damage in Suburban and Rural Landscapes**

This is a collaborative effort among Extension wildlife specialists in the Northeast to help resolve significant human-wildlife conflicts via regional research efforts, technical assistance to affected parties, and education program development and delivery. Because of the overwhelming number of problems characteristic to the area, the team decided early on to restrict initial efforts to a focus on deer damage. Given that, the project's defined objectives include: 1) improve techniques to assess economic and ecologic damage from deer, 2) explore enhanced technologies to reduce or eliminate deer damage, 3) explore new and restructured approaches, policies, and practices to mitigate deer damage, 4) improve public stakeholder engagement in decision making regarding deer damage management, and 5) develop and conduct innovative Extension and technology transfer programs. Even though the project has been operational for only a short period of time, it has already led to a noticeable improvement in communication among agencies and other providers who have responsibility to serve the public.

**Multistate Project Research to Develop Methodologies for Direct Detection of Pathogens in Water**

Microbial source tracking (MST) emerged as a new technology about 12 years ago and has since been deployed nationwide to identify sources of fecal pollution in water. Over time, many researchers reported problems with approaches that required known source libraries, and multistate project S-297 was designed to evaluate one of the best MST methods, ribotyping. Results demonstrated that the DNA ribotypes of the most widely used fecal indicator bacteria varied with geographical area, time of sampling, stream flow conditions, and animal diet. These results indicated that library-dependent MST methods will require tens of thousands of isolates, will be time-consuming, and expensive to construct and maintain. S-297 then changed direction to focus on three library-independent approaches. The first, targeted sampling, was developed as a way to reduce the effects of bacterial changes with geography and time. By reducing environmental complexity, existing MST methods could be performed faster and cheaper. The second approach was based on fluorometry, a chemical method that works by detecting optical brighteners from laundry detergents in water from malfunctioning septic drain fields and leaking sewer pipes. Results to date indicate that fluorometry is an acceptable, inexpensive method to detect human sewage in fresh and marine waters. The third approach was the development of a species-specific DNA primer that works in a biosensor to detect DNA sequences of *Ent. faecalis*. This is a positive first step in the development of an inexpensive new technique to rapidly detect pathogens directly in water. This research is continuing under new multistate project S-1022.

**Southern Region Pesticide Safety Education Center**

The Southern Region Pesticide Safety Education Center (PSEC) was developed in 2000 to provide train-the-trainer support and training to Extension agents, specialists, and pesticide regulatory personnel in the south. The Center is physically located at North Carolina State University. States throughout the south support the center with personnel, media, and on-line course support. Virginia Tech Pesticide Programs has created and sponsors an on-line course that is part of the PSEC workshops. To date, over 250 pesticide safety educators have participated in the PSEC workshops. As part of attending a workshop in Raleigh, North Carolina, one must first take the on-line course. This partnership has gained recognition as a unique mulitstate partnership and has served as the model for the formation of a new Northeast Center in 2005. The Northeast Region uses the Virginia Tech on-line course in a similar manner to that used in

the Southern Region. Both centers have included participants from many states outside their regions because their activities are valuable to other pesticide safety educators and regulators in training their personnel. The critical issues addressed by this activity not only involve a source of needed training for trainers, but the subjects address environmental, health, and safety issues. These issues involve protecting the environment, the public, and the applicator from pesticide misuse. Activities associated with the PSEC are published in the *Journal of Pesticide Safety Education*, shared with pesticide safety educators throughout North America through the American Association of Pesticide Safety Educators, and are documented in impact reports through the various cooperators' programs.

**Water Quality Methodology for Crop Protection Chemicals**

Virginia State University (VSU) and Virginia Tech are involved in multistate project S-1011, "Water Quality Methodology for Crop Protection Chemicals." Others involved are Clemson University, Mississippi State University, Texas A&M University, University of Arkansas, University of Puerto Rico, University of Tennessee, and the USDA-Southwest Watershade Research Laboratory, Agricultural Research Service, Tifton, Georgia. The objectives of the project are: 1) Compare and evaluate various solid phase extraction techniques using disk, fiber, and cartridge devices for sampling water for a wide range of crop management chemicals, 2) Investigate the storage stability and transportability of crop management chemicals extracted utilizing various SPE matrices for application to field extraction procedures, 3) Investigate the problems associated with the usefulness of successful SPE matrices for investigations involving turbid water samples, and 4) Investigate the feasibility of using developed procedures for field extractions for crop protection chemicals. The improvement in analytical techniques for the analysis of crop management chemicals is important to air, soil, and water resource conservation and enhancement, natural resource and ecosystem management, environmental policies and regulations, risk management and assessment in agricultural systems, and agriculture-related social and consumer concerns which are associated with these objectives. To accomplish these objectives, valid and sensitive analytical techniques for the presence of crop management chemicals upon which the general public and stakeholders can rely must be provided. The team has met twice and conducted the first year experiments as proposed. The results are now compiled for submission of a manuscript entitled, "Pesticide Extraction Efficiency of Two Solid Phase Extraction Disk Types after Extraction and Shipping."

**Recertification Program for Pesticide Applicators certified in Right-Of-Way Pest Control (6) - Nebraska and Virginia**

People who use pesticides on rights-of-way must hold a certificate issued by the state (or states) in which they work. To keep a certificate in force, the holder must participate in a state-approved continuing education program. At the request of the University of Nebraska--Pesticide Education Resources, Virginia Extension specialists designed and delivered a recertification program for applicators in this category for use in Nebraska in 2006. The two Virginia cooperators designed and produced a four-part program (three narrated PowerPoint presentations and a video). In Nebraska, a DVD will be distributed to Extension educators statewide. The same program will be put on the agent-only portion of the Virginia Tech Pesticide Programs website for VCE ANR agent access.

***Goal 5: To enhance economic opportunities and the quality of life among families and communities***

**4-H International Exchange Program**

The 4-H International Exchange Programs provides experiential educational and development experiences that: help young people and their families understand the importance of knowing about other countries and the United States and their respective cultures; instill positive cross-cultural attitudes and skills that enhance mutual understanding and acceptance of all people; expand the opportunities for young people to experience global citizenship responsibilities in today's interdependent world; increase self-esteem and confidence through adapting to new situations; learn languages and communication skills; and, increase overall global awareness. Over 1,000 United States families benefited from these experiences in 2004 and 2005 by hosting an international delegate or by having a 4-H member travel overseas to live with a host family. While 4-H international exchange programs involve people of all races and socio-economic backgrounds, the inherent mission of the program serves to develop attitudes in young people that will make them more accepting of people different from themselves. Evaluation information taken from the 4-H Japanese Exchange Program Evaluation Report of December 2003, documented the following. Youth traveling to Japan rated the following life skills as those most affected by the trip: appreciating another culture, making friends with new people, understanding they have a lot in common with people from other cultures, sharing their experience with others, being comfortable in new situations, caring about people who are different than themselves, being responsible for themselves, and being resourceful. Host youth reported the following as most significant: understanding they have a lot in common with people from other cultures, caring about people who are different than themselves, appreciating another culture, and sharing their experience with others. Host adults reported that the experience of hosting an international student helped develop the following life skills in their children: understanding they have a lot in common with people from other cultures, appreciating another culture, sharing their experience with others, making friends with new people, caring about people who are different than themselves, accepting differences in others, introducing another person to strangers, working in cooperation with others, and being comfortable in new situations.

**Agricultural Risk Management Project**

Virginia State University served as a lead institution in a multi-state collaborative effort with University of Minnesota--Center for Farm Financial Management, University of Arkansas--Pine Bluff, Tuskegee University, and the National Crop Insurance Services to implement a risk management project in 2005. The goal of the project was to conduct training in agricultural risk management tools to provide effective crop insurance and financial education to underserved producers in Virginia, Arkansas, and Alabama. The objectives were: 1) to develop limited resource case farm examples that document the actual financial plan and the crop insurance decision-making process for representative farms, 2) to use case results to prepare instructional materials for training limited resource producers, 3) to conduct producer workshops in Virginia, Arkansas and Alabama for select groups of limited resource and socially disadvantaged producers who might be viewed as early adopters to successfully utilize crop insurance products and financial management tools so they can provide an example for other limited resource producers, and 4) to continue to support cooperation among a network of educators and advisors

who help limited-resource and socially disadvantaged producers improve their financial management abilities. Three limited resource case examples were developed with representative farms from Virginia, Alabama, and Arkansas. The case materials were used to conduct producer training in Arkansas, Alabama, and Virginia. Through this project**,** collaborators created crop insurance and financial management educational materials to support training for agricultural producers and for training educators of limited resource and socially disadvantaged farmers and ranchers.

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

**Institution** Virginia Polytechnic Institute and State University (Virginia Tech)
**State** Virginia

**Check One:**
___ Multistate Extension Activities
__X__ Integrated Activities (Hatch Act Funds)
___ Integrated Activities (Smith-Lever Funds)

| Title of Planned Program Activity | FY 2000 | FY 2001 | FY 2002 | FY 2003 | FY 2004 | FY 2005 |
|---|---|---|---|---|---|---|
| 1) To achieve agricultural production system that is highly competitive in the global economy. | $204,000 | $257,000 | $246,000 | $250,000 | $300,000 | $421,987 |
| 2) To provide a safe and secure food and fiber system | 55,000 | 59,000 | 50,000 | 40,000 | 65,000 | 91,431 |
| 3) To achieve a healthier, more well-nourished population. | 34,000 | 40,000 | 20,000 | 30,000 | 49,000 | 68,768 |
| 4) To achieve greater harmony (balance) between agriculture production(production activities) and (stewardship and protection of) the environment. | 49,000 | 56,000 | 50,000 | 45,000 | 72,000 | 100,808 |
| 5) To enhance economic opportunities and the quality of life among families and communities. | 54,000 | 63,000 | 55,000 | 56,000 | 70,000 | 98,464 |
| **Total** | $396,000 | $475,000 | $421,000 | $421,000 | $556,000 | $781,458 |

Craig Nessler — **Director**
4/12/06 — **Date**

**Form CSREES-REPT (2/00)**

***Note: The 14% target was met in FY 2005***

# Brief Summaries of Selected Integrated Activities (Hatch Act Funds)

***Goal 1: To achieve an agricultural production system that is highly competitive in the global economy***

**Identification, Characterization, and Control of Herbicide-Resistant Weeds in Virginia's Agronomic Crops**

With increased reliance on relatively few highly specific herbicides, several weeds have developed herbicide resistance. These weeds present serious threats to crop productivity through competition and cost of alternative controls. More resistant weeds are likely to be detected. The purpose of this project is to identify newly developing herbicide-resistant weeds and develop alternative control methods. The results will be disseminated to Virginia producers. Reports of suspected resistance in the field were investigated in cooperation with local growers, agriservice representatives, and county Extension agents. Field trials were conducted in small plot format to evaluate alternative control programs. In 2005, the initial year of use of mesosulfuron, efficacious and cost-effective control of diclofop-resistant ryegrass was observed. Glyphosate continued to be used in glyphosate-tolerant corn hybrids for the control of ALS-resistant shattercane on essentially all corn acreage where this resistant species has been confirmed. However, the experimental pre-emergence herbicide continued to be efficacious. Its registration would afford an alternative with regard to resistance management. Differential response to glyphosate was confirmed in 2005 in common lambsquarters plants derived from additional seed collections. The infestation pattern of common lambsquarters with reduced sensitivity to glyphosate was monitored. At this time, impact on production agriculture is minimal. The potential impact, however, of the spread of a biotype of this weed species with reduced sensitivity to glyphosate is substantial.

**Integrating No-Tillage with Farmscaping and Crop Rotations to Improve Pest Management and Soil Quality in Organic Vegetable Production**

Conventional tillage and cultivation practices used by most organic growers reduce soil quality and productivity. Likewise, high incidence of pests, especially weeds, limit crop yield and increase production costs. This project examines the potential of using diverse crop rotations and no-tillage systems to achieve cost-effective management of weeds and other pests and improved soil quality and productivity in organic farms. In 2005, sweet pepper was grown organically in Virginia and Georgia to evaluate the effects of cover crops, tillage (conventional - CT, and no-till - NT), and farmscaping on crop yields, pest management, and soil quality. Based on grower interest and attendance at four successful field days held in 2005, organic farmers believe that high-biomass/cover-cropping NT systems hold great potential to improve their productivity and sustainability. Over time, as organic growers obtain sufficient knowledge and equipment, we fully expect that they will adopt NT systems because of current emphasis on soil conservation, building soil quality, and environmentally sound production practices.

**Cultural Practices to Enhance the Ecology and Economy of Container Plant Production**

Sustainable horticulture must maximize resource use efficiency to maintain the production levels necessary to compensate for rising land values and increasingly scarce fresh water supplies. The purpose of the project is to investigate effective strategies for efficient use of water, nutrients, biosolid wastes, space, and time in the production of quality nursery crops. Promotion of earlier

flowering on camellias will reduce production time and costs for the growers, and will make more cultivars available to consumers. Container media or nutrient treatments that suppress Phytophthora disease will help reduce use of fungicides in commercial production of azaleas. Data showing a reduction in Phytophthora inoculum survival due to pressure and spray forces are expected to lead to the development of alternative methods of water decontamination using fewer chemicals in nursery irrigation systems. Other results showing that triazole fungicides are likely to provide growth retardation in addition to that from a previously applied PGR gives nursery and greenhouse growers information that should be considered when selecting PGR application rates or class of fungicide to use.

**Improving the Design of Breeding Schemes in Ruminant Livestock, Using a Sheep Paradigm**

The small size of many purebred flocks and herds constrains opportunities for genetic improvement. The purpose of this study is to devise cooperative breeding schemes that accelerate genetic progress yet allow flexibility among participants in their breeding decisions to encourage the uptake of such schemes in practice. The findings will apply to ruminant livestock, particularly to sheep and beef cattle. Purebred seedstock operations are the source of genetic improvement in commercial sectors of ruminant livestock industries. The small size and limited recording within these operations means higher genetic gains could be achieved through formation of cooperative schemes, or adaptations of them, with financial benefits to ruminant industries in the state. The research completed suggests that with systematic sharing of rams, which is the norm with the purchase and trade of rams among flocks, genetic links will be established. A statistic has been developed to gauge the strength or sufficiency of those genetic links. Its values can be used to determine whether additional steps are necessary within breeding cooperatives or, for that matter, entire breeds to ensure that genetic comparisons across flocks are equitable. The anticipated impact of this program is to encourage the uptake of cooperative breeding schemes in Virginia. Because the characteristics of purebred flocks and herds in Virginia are common elsewhere in the eastern United States, such approaches also have regional importance. Furthermore, if enthusiasm for forming cooperative schemes begins with a few neighboring flocks or likeminded breeders, initiation of such smaller schemes poses clear advantages to the formation of larger cooperatives in the future. The opportunities that cooperative schemes offer have been publicized regionally and internationally with positive industry response. Because the impact of such technologies is dependent on industry uptake, such outreach is central to this project.

**Evaluation of Maize Germplasm, Hybrids, and Inbreds for Resistance to Gray Leaf Spot Disease, Under No-Tillage Production**

Gray leaf spot (GLS) of maize, caused by the fungus *Cercospora zeae-maydis* (Czm) has increased in incidence and severity with the adoption of no-tillage production practices. Serious losses have occurred sporadically in areas of the United States cornbelt and more recently in the southern two-thirds of the African continent. In Virginia in 2005, nearly 2,000 elite maize hybrids and inbreds were evaluated for reaction to Czm under conditions highly conducive to GLS development at the University's research farm in Montgomery County, Virginia. Fifteen elite hybrids were evaluated for disease reaction and agronomic traits. Yields ranged from 11,076 to 6207 kg/ha. Hybrids with the least blighting produced the highest yields. Identification of hybrids adapted to Virginia with higher levels of GLS resistance has consistently resulted in

20 to 60 percent yield increases over more susceptible widely grown hybrids. The acceptance and use of hybrids identified by this project as less susceptible have saved Virginia corn farmers nearly $15 million per year from grain losses due to GLS on approximately 121,000 ha.

**Dynamic Soybean Pest Management for Evolving Agricultural Technologies and Cropping Systems**

Soybean growers have recently experienced increases in certain insect pest problems and the introduction of a new and potentially significant pest species. Soybean aphid, introduced from Asia, is now widespread across much of the United States and could result in production losses and increased insecticide use. This project coordinates the efforts of entomologists across the United States to conduct pest surveys and develop control tactics. Pest surveys and field trials improved insect pest management practices by Virginia soybean growers. A total of 7,750 ears of corn sampled for second generation corn earworm from 23 Virginia counties showed that 22 percent were infested, which was lower than the 37 percent reported for 2004. A series of 19 black light traps revealed lower moth activity throughout July and August compared with previous years. Forty-five pest updates were posted from June through September to the Virginia Ag Pest Advisory website and to over 350 e-mail clientele subscribers. As a result, growers scouted almost 63 percent of the total soybean acreage for corn earworm and treated just over 30 percent for corn earworm, a significant reduction compared with many previous years. Eighty-nine soybean fields in 40 counties were monitored weekly from early May through early October for soybean aphid. All fields became infested. A new Speed Scouting program for determining economic threshold and the need to treat fields with insecticide was developed and distributed via Macromedia Breeze. As a result, only an estimated 2,703 hectares were treated -- primarily those that reached or exceeded the aphid threshold. Two experiments were conducted on growers' fields to evaluate the efficacy of seven insecticides in three insecticide classes against soybean aphid. Results showed that Karate Z, Orthene 97, and Lorsban 4E provided greater than 95 percent control at four days post treatment. Prolex 1.25, Asana XL, Baythroid 2, and Centric 40WG were less effective. These data improved product selection by growers.

***Goal 2: To provide a safe and secure food and fiber system***

**Biogenic Amines in Finfish Species**

Biogenic amines are natural anti-nutrition factors that have been implicated in food poisoning episodes. Thus, they have been suggested as a standard of quality and safety in finfish species. Normal concentrations of the compounds in major finfish species must be determined as well as the effects of storage conditions and processing variables on their production. State and federal food regulatory agencies may establish unrealistic low defect action levels unless the presence and significance of concentrations are identified, which could lead to unnecessary product loss and litigation. The study showed that current harvesting, handling, processing, and transportation procedures utilized in the mid-Atlantic region with scombroid and scombroid-like fish were sufficient to prevent scombrotoxin formation in consumed products. Current cleaning and sanitation procedures showed that few bacteria species were present on food contact surfaces having decarboxylase enzyme activities that are required for toxin formation. All fish analyzed in the study had histamine contents less than, or equal to, 15 ppm, which is less than the Food and Drug Administration (FDA) action level of 50 ppm. This low level of histamine formation was also true of Atlantic mackerel and bluefish held for several hours during the summer without

refrigeration and then held until spoilage occurred (five days). Recommendations identified by the study will improve quality and food safety. Large fish (mahi-mahi, yellow fin tuna) were not always able to meet the FDA requirement for obtaining the internal cooling temperature within the specified time period. Improved cooling procedures are necessary to be able to meet the FDA recommended 6-hour HACCP guideline. This could be achieved through improved icing procedures using only ice or the implementation of ice slurries. It is further recommended that fishing vessel operators perform cooling rate studies on uneviscerated fish using data loggers (time-temperature recorders) to verify their handling practices are in agreement with FDA guidelines for scombroid and scombroid-like fish.

**Enhancing Food Safety through Control of Food Borne Disease Agents**

Certain agricultural practices contribute the contamination of raw produce with food borne pathogens. Raw produce can receive antimicrobial treatments to reduce food borne pathogens. The purpose of the study is to develop a central evaluation method for the use of antimicrobial treatments on fresh produce. This project will validate the effectiveness of HACCP systems in food processing plant environments. The results of this study indicate that ultraviolet (UV) light could achieve a greater then 5-log reduction of *Listeria monocytogenes* in raw goat's milk. The development of an apparatus that can achieve maximum turbulence within the quartz tube with a holding time long enough to administer the proper amount of UV irradiation would be beneficial for further studies. Future research would assess lipid and protein oxidation and organoleptic properties of the irradiated milk. This technology will give smaller dairy processors a more economical way to pasteurize their milk, which will increase economic viability in rural areas.

**Prevention and Reduction in Microbial Pathogens during The Production, Processing, and Preparation of Poultry**

Production of edible poultry products during the continuum of farm rearing of birds through processing and preparation presents many opportunities for microorganisms to proliferate or contaminate raw products. This project seeks ways to prevent pathogenic bacteria from contaminating poultry products, to reduce the populations of microorganisms during processing, and examines sampling procedures to characterize a microbial population from live poultry. Strains of epidemic-associated clonal groups of *Listeria monocytogenes* may have reservoirs in processing plants, and they undergo genomic diversification there, which needs to be taken into consideration in the analysis of their ecology and epidemiology. The results from this study will be used to identify relevant critical control points for these select pathogens in turkey processing plants and to aid in developing methods to effectively eliminate these pathogens from the processing environment. This project demonstrated the relative effectiveness of microbiological sampling methods that may be used to detect *A. butzleri* from chickens or their environment. Poultry growers and researchers can now optimize their sampling methods and sampling plans to aid their ability to detect and control this pathogen. Exposure of boneless, skinless chicken breasts to ultraviolet (UV) radiation may not significantly benefit the keeping quality or the shelf life of this product. While the UV treatments had a minimal impact on the taste of cooked chicken breast, these treatments would not be an effective way to reduce bacterial numbers on raw chicken. The use of alternative antimicrobial and surfactant chemical sprays, including cetylpyridinium chloride, for pre-chiller chicken carcasses, can decrease the incidence or concentration of microbial pathogens on these carcasses.

*Goal 3: To achieve a healthier, more well-nourished population*

**The Role of Antioxidant Supplements on Mitochondrial Function**

Harmful oxidants, present in our food, air, and water are responsible for conditions such as aging, heart disease, cancer, arthritis, diabetes, cataracts, and Alzheimer's disease. We examined the effects of potential food antioxidants to reduce the effects of oxidants on sub-cellular units in cells from farm animals. Obesity is strongly related to heart disease and type 2 diabetes. Both conditions are known to have strong relationships with markers of inflammation. Uncoupling protein 2 (UCP2) expression in mitochondria is believed to reduce the formation of reactive oxygen species (ROS) and subsequent inflammation. Our data on animals lacking UCP2 protein (UCP2 knockouts) reveal that UCP2 acts to reduce inflammation and reactive oxygen species formation. Conjugated linoleic acid, a key agonist for the PPAR gamma transcription factor reduced markers of oxidative stress and inflammation to a greater extent in control than UCP2 knockout mice. This points to a strong connection between mitochondrial expression of UCP2 and formation of reactive oxygen species and inflammation, known inducers for chronic diseases such as type 2 diabetes and heart disease.

**Bone Mineral Density and Markers of Bone Turnover in Young-Adult Female Chronic Dieters**

With chronic dieting, the complement of nutrients required for optimal bone health becomes limited. Yet, the impact of chronic dieting practices on bone health among young-adult women is unclear. The purpose of this research is to determine the impact of chronic dieting on bone health among otherwise healthy young-adult women, while controlling for body mass and physical activity. This research has begun to clarify the impact of cognitive eating restraint and dieting habits on bone mineral density and bone metabolism of young-adult women. Cognitive eating restraint and chronic dieting cannot be used interchangeably to describe the process of controlling food intake for weight management. Young-adult women with high cognitive eating restraint did not also have high salivary cortisol or other hormonal indicators of stress. Although women with high cognitive eating restraint had higher body fat and an associated higher serum leptin concentration than women with low cognitive eating restraint, these measures did not relate to bone mineral density measures.

*Goal 4: To achieve greater harmony between agriculture and the environment*

**Economic and Environmental Evaluation of Evolving Sustainable Agricultural Production Systems**

Some agricultural production systems have adverse environmental impacts and can be considered unsustainable. The purpose of this study is to determine the economic viability of sustainable agricultural practices and to determine factors that will enhance their economic viability and thus their adoption. The analysis of the survey of organic producers has provided information about their research and outreach needs that will help guide these programs at Virginia Tech and other land-grant institutions. That is, improved policy prescriptions can be provided to decision makers and more specific recommendations can be made to producers about organic production. In addition, the different demographics of this clientele groups suggests that non-traditional approaches, such as using the Internet may be a cost-effective delivery method for outreach programs. Neural networks are a promising technique for limited dependent variable

modeling. They can produce more accurate predictions and substantially different economic results than the standard statistical techniques. In this pilot study, Logit and Probit models were found to over-predict the public's willingness to pay for water-quality protection in a river basin by 13 percent. Results of the innovation study suggest that relatively simple statistical models as opposed to more complicated analyses often found in the literature are sufficient to identify agricultural innovators. A scoring method that can be used in future innovation/adoption studies was employed to identify agricultural innovators and their degree of innovativeness. The research on incorporating risk into the existing economic analysis of recirculating aquaculture systems provides a prototype spreadsheet and users guide which individual entrepreneurs will be able to adapt to their own highly diverse production systems.

**Soil Information Systems to Support Land-Use Decisions**

Coding is complete and field-testing is underway for two software applications developed to assist decision makers dealing with landscapes suitable for onsite septic systems. Site evaluations for septic system suitability in Virginia are subject to regulation and soil property interpretation. Currently, these evaluations are not stored in database format for later retrieval or study. Accuracy and precision of onsite septic system evaluations can be improved with development of a decision-support tool that uses stored soil descriptions, and makes them available for further research and to improve the knowledge base of onsite evaluators. VA Septic System is a new public domain software Extension, part of USDA-Natural Resource Conservation Service Soil (NRCS) Data Viewer that works with ArcView 3.2a, a popular GIS software program. This tool allows linkage of the digital soil survey attributes provided by USDA-NRCS digital soil surveys with Virginia Department of Health (VDH) regulations for one conventional and five popular alternative septic systems, and uses fuzzy logic abilities to evaluate rules. The initial program is complete, and the NRCS state soils staff in Virginia is gathering available digital data from three physiographic province areas of Virginia to further test the program. Probability of septic system failure will be calculated for each component of each map unit, then a dominant soil, dominant condition, most limiting, and least limiting component probability of failure reported. The end product will be an interpretive map with suitability potentials that can be used in GIS programs for planning. The second software application, VA On-site, may be used on-site by field investigators to determine if the soil being actively examined and described will qualify for a conventional or one of five alternative septic systems under current VDH regulations. VA On-site uses Microsoft Access to store data and generate printed reports to be sent to VDH for system approval. The Access program will allow investigators to use a portable computer to review rules on-site for soil and site suitability. Coding of VA On-site is also complete and is being field tested for use by NRCS. Both programs will be distributed freely to the public through a Virginia Tech College of Agriculture and Life Sciences web site. The VA Septic System-Soil Data Viewer tool can be used by town and city planners, soil scientists, and businesses in Virginia to view preliminary site interpretations for septic system suitability before proceeding with more costly and detailed on-site investigations. The consistent decision-support system format developed by this project will be shared with USDA-NRCS staff in other states so that they may adapt the program for use with rules in their state. Students and educators will also use the tool for class projects. The VA On-Site tool will be used extensively throughout Virginia by on-site septic system evaluators. This software will be especially useful to small businesses in need of standardized record-keeping software. Since two-thirds of new Virginia homes use septic systems, the impact of this tool will be to enable more rapid and consistent evaluation and

processing of septic system applications. The embedded rules will be used to educate and train on-site evaluators about VDH regulations, and thus should enhance Virginia's consultant businesses, aid the homebuilding industry, and better protect the health of the Commonwealth's citizens, waters, and other natural resources.

**Impact Analysis and Decision Strategies for Agricultural Research**

Public agricultural research can have sizable but uneven benefits and costs. New biotechnologies have received attention recently because of potential but unknown health, environmental, and economic effects, both positive and negative. The purpose of this study is to estimate the size of the net gains to agricultural research and development. It is also designed to estimate the distribution of those gains, especially with respect to effects on limited-resource farmers and consumers. Having estimates of the economic impacts of IPM and of the cost effectiveness of Extension methods used for IPM enables public decision makers to tailor their research and Extension programs to achieve the greatest impact. Acceptability of transgenic crops may be influenced by the magnitude of expected economic benefits that offset expected risks. While it is not possible to estimate the economic value of this research project with any precision without a separate project to do so (because the estimated benefits of some of the transgenic crops studied are over a $1 billion spread over 15 years), if the evaluation research has only a one-percent chance of speeding up the release and adoption of just one transgenic product, for example, *Bt* rice, by just one month, the economic benefits would more than pay for all of the research costs. Economic benefits from transgenic crops in Asia help to reduce poverty and malnutrition in a region that contains more than half of the world's poor and malnourished.

**Chemistry, Bioavailability, and Toxicity of Constituents in Residuals and Residual-Treated Soils**

Land application of municipal, agricultural, and industrial waste products requires practical scientific information to determine if the nutrient and trace element constituents can be beneficially reused without harming the environment or the health of humans, plants, and livestock. The W-1170 multistate committee members conduct research that evaluates biogeochemical cycling of plant nutrients, movement of trace elements into the food chain, potential toxicity of pollutants to soil and water ecosystems, and long-term bioavailability of trace elements in residuals and residual-amended soils. Our research addresses environmental issues surrounding the risk assessment and regulations (i.e., Federal USEPA 503 Rule and state) governing the land application of biosolids (treated sewage sludge) to investigate the validity of the scientific basis for the regulations. Our research specifically addresses nitrogen, phosphorus, arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium, zinc, and other trace elements of emerging concern. The clientele for the results of the W-1170 research activities include state government regulatory agencies, for the purpose of developing regulations that are protective of human, livestock, and plant health and the environment; local government decision makers, for the purpose of approving zoning and land use ordinances that protect their citizens; and farmers, for the purpose of employing waste application practices that enhance their production systems and protect their health. Results are delivered to state regulatory agencies by serving on technical advisory committees for the Virginia Department of Health (Biosolids Use Regulatory Committee) and the Department of Environmental Quality (Water Reuse Regulations) and by providing regular advice to the Department of Conservation and Recreation for the modification of the Nutrient Management Regulations. Results are delivered to local

government decision makers and farmers by providing both written documents (Extension publications, recommendations, and statements in response to questions) and oral presentations at county and city public information meetings and public hearings and via training of Extension field faculty, who deliver programs directly to farmers. The multistate W-1170 workgroup is primarily a research group, whose results are reported in the annual reports and in refereed research journals, conference proceedings, and trade journals. The research has demonstrated that biosolids of sufficient quality can be used as a beneficial soil amendment and inexpensive fertilizer without causing environmental problems. Research results have been used to modify the Virginia Department of Health Biosolids Use Regulations to provide increased environmental protection. Educational materials have been used to help assure local government decision makers and farmers of the benefits and safety of land applying biosolids. By demonstrating that the land application of biosolids can be a safe and beneficial practice, farmers who have received the biosolids as a free fertility amendment have been able to save $50.00 to $100.00 per acre in the cost of fertilizer and lime on the greater than 30,000 acres of land in Virginia that receive biosolids annually.

***Goal 5: To enhance economic opportunities and the quality of life among families and communities***

**Determinants of Rural Poverty in Virginia and the United States**

This project examines the determinants of changes in poverty between 1990 and 2000 in rural United States counties using census data augmented with additional sources of information. Factors such as economic change, human capital attainment, and policy shifts were examined. Preliminary statistics and regression results have been obtained and analyzed. Results show that underlying structural factors including population density, human capital attainment, and economic structure all affect changes in poverty. In particular, counties with heavy dependence on manufacturing have done worse (in terms of poverty reduction) than more diversified counties and those with more dominant service sectors. Investments in education, whether measured through educational attainment of citizens or measures of school performance, are positively associated with poverty reductions. Substantial heterogeneity exists across the rural United States and ongoing research is designed to address and model this heterogeneity. For instance, clustering or neighborhood effects (an area's ability to reduce poverty depends on neighboring conditions) are quite important and need to be dealt with more effectively. Enhanced information about determinants of poverty reduction will enable decision-makers at the local, state, and national levels to better address problems of persistent poverty. In fact, more than 200 rural counties have been identified as being persistently poor (i.e. with poverty rates above 20 percent in the 1960, 1970, 1980, 1990, and 2000 censuses). Policies to address these conditions are urgently needed. Information from this project can be used to evaluate the need for education, job training, industry recruitment, and infrastructure investments in reducing rural poverty. This information will enhance to poverty-reducing impacts of public investments and reduce unnecessary expenditures.

**Rural Communities, Rural Labor Markets and Public Policy**

Rural America is experiencing substantial demographic and economic change and its future depends on solid policy analysis. Rural labor markets, being buffeted by economic change, may help rural America prosper in the 21st century. This project examines how rural markets adjust to

economic change and how policy can be formulated to assist these adjustments. Enhanced information about constraints to increased renewable fuel production in Virginia will allow policy makers to decide about alternative actions to promote such production. For instance, the study does not recommend continued incentives for solar and wind generation in the state. Further research (for example--engineering solutions to reduce costs of switchgrass processing and transportation) is needed to lower economic barriers to more switchgrass production. It is estimated that a single 600MW coal-fired power plant that co-fires with five percent switchgrass would improve the financial viability of about 140 farm families and have total economic impacts of more than $2 million per year.

**Assessing Impacts of Welfare Reform on Individual, Family, and Community Well-Being in the Rural South**

Many single female-headed families in rural areas face the loss of public cash assistance payments under current welfare reform measures. This project examines changes in the economic well being of non-metropolitan single female-headed families with children during the implementation of welfare reform measures. Understanding the characteristics and conditions that allow working families to move out of poverty is crucial for the development and implementation of welfare reform initiatives that both promote workforce participation and reduce poverty. The published policy implications from this research suggest that legislation aimed at lifting working families out of poverty needs to focus on stemming the erosion of wages in low-skill jobs. The results also have implications for workforce training programs by demonstrating that educational investments may also reduce the exposure of working families to poverty. However, such investments must be made at the community-college level to effectively reduce working poverty.

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

**Institution** Virginia Polytechnic Institute and State University (Virginia Tech)
**State** Virginia

**Check One:**
___ Multistate Extension Activities
___ Integrated Activities (Hatch Act Funds)
__X__ Integrated Activities (Smith-Lever Funds)

| Title of Planned Program Activity | FY 2000 | FY 2001 | FY 2002 | FY 2003 | FY 2004 | FY 2005 |
|---|---|---|---|---|---|---|
| 1) To achieve agricultural production system that is highly competitive in the global economy. | $397,000 | $547,000 | $641,000 | $600,000 | $560,700 | $670,962 |
| 2) To provide a safe and secure food and fiber system | 72,000 | 129,000 | 142,800 | 14,000 | 112,800 | 134,982 |
| 3) To achieve a healthier, more well-nourished population. | 27,000 | 16,000 | 5,400 | 6,500 | 71,100 | 85,082 |
| 4) To achieve greater harmony (balance) between agriculture production(production activities) and (stewardship and protection of) the environment. | 142,000 | 166,000 | 144,400 | 118,000 | 154,500 | 184,882 |
| 5) To enhance economic opportunities and the quality of life among families and communities. | 90,000 | 17,000 | 32,000 | 225,000 | 79,800 | 95,493 |
| **Total** | $728,000 | $875,000 | $965,600 | $963,500 | $978,900 | $1,171,400 |

Mark McCann — **Interim Director**
4/12/06 — **Date**

**Form CSREES-REPT (2/00)**

***Note: The 14% target was met in FY 2005***

# Brief Summaries of Selected Integrated Activities (Smith-Lever Act Funds)

***Goal 1: To achieve an agricultural production system that is highly competitive in the global economy***

**Lifetime Economic Merit of Holsteins, Jerseys, and Reciprocal Crosses**

Virginia Tech and Kentucky dairy herds include purebred Holstein and Jersey cows, cows sired by Holstein bulls out of Jersey dams, and cows sired by Jersey bulls out of Holstein dams. Many different traits have been measured during the calf-rearing period and are beginning to be measured as these animals mature and calve into the two milking herds. We have presented abstracts at the last two annual meeting of the American Dairy Science Association and will submit additional abstracts this year. Material presented in these abstracts has been used as subject matter for talks with producers and dairy industry personnel in North Carolina, Virginia, New York, and South Africa. The results have been included in popular press articles. This spring, North Carolina will become a member of the project as their first project calves will be born in the Goldsboro, North Carolina research grazing herd. We expect to ultimately be able to declare whether crosses of Holsteins and Jerseys are more profitable across their lifetimes than the two pure parent breeds. We expect to quantify breed group differences in health, fitness, and fertility traits. We expect to measure breed group differences in a large variety of performance related events from calfhood survival and growth to milk production and cull cow value.

**Analysis of the Transportation Needs of the Wood Products Industry in Distressed Appalachian Regions**

The Appalachian Regional Commission (ARC) with support from the Virginia Port Authority (VPA) and the West Virginia Department of Transportation (WVDOT) asked Virginia Tech to review transportation issues affecting the wood products industry. Virginia Tech's Department of Wood Science and Forest Products, the Office of Economic Development and its Transportation Institute conducted the research. A fax/e-survey was completed by 48 hardwood manufacturers in the Appalachian region in the spring of 2005. Twenty-six sawmill personnel and 48 community leaders and transportation professionals were interviewed in the spring and summer of 2005. Participants were asked to provide information on a variety of subjects, including domestic and international markets, understanding intermodal facilities, transportation procedures, shipping issues, and port issues. At the international level, participants were asked about factors that limited competitiveness. Responding hardwood manufacturers reported 93 percent of their products by volume were shipped by truck to domestic markets in 2004. Seven percent of their product was shipped by rail in the domestic market. Responding hardwood manufacturers did not transport any products by barge or ship to domestic markets. The major transportation problems affecting manufacturers' competitiveness in the market are fuel costs, county issues, weight restrictions, inconsistent regulations among states, lack of rail cars and railroad costs, lack of drivers for hauling the lumber, and truck traffic. Thus, it is difficult for the mills to move hardwoods quickly and easily to markets. Safety issues, driver accidents, high rates ($1.85 to $2.00 per mile), and location issues came up a few times as well. The community leaders, transportation professionals, and economic development specialists were aware of the importance of the wood products industry to the region and were overwhelmingly supportive of the industry as a whole. However, the ability of the cluster areas -- Mississippi and Alabama; West Virginia and Virginia; and Pennsylvania and New York -- to aid the industry varied as did

the amount of assistance the areas were able to provide to the sawmills. The level of support provided depended on funding, political pressure, legislative restrictions, and professional ability. Overwhelmingly, the leaders and professionals were very supportive of intermodal facilities. In all three areas, some level of analysis had already been conducted on the appropriateness of a facility and possible localities for an inland transportation hub. The results have been disseminated through presentations in West Virginia and Washington, D.C. and will be presented to an industry-wide trade association meeting in February. It has been in newsletters to economic developers and the industry.

**Growing Hulless Barley in the Mid-Atlantic**

Barley acreage has fallen in recent years, from near 40,000 ha in the early 1980s to less than 17,000 ha in 2003. This rapid decline is due to lower prices paid for grain. In fact, barley that was worth over $103.00 Mg-1 in the late 1990s has fallen to a value of less than $64.00 Mg-1 today. The goal of the program is to introduce to the market higher energy density hulless barley to increase the price paid for barley and producer income. New hulless barley types, such as the 2003 release 'Doyce', have been shown to deliver higher quality feed, lower starch, and higher prices than traditional barley, however, lack of management information could limit adoption. Research trials are being conducted in Virginia, Maryland, Pennsylvania, and Delaware to refine management techniques. A VCE fact sheet (424-022) has been developed and will serve as the cornerstone of the information-dissemination process. Over 10 field days and educational meetings have been conducted in conjunction with the Virginia Small Grain Grower's Association and the Virginia Crop Improvement Association where hulless barley was a key component. Strategically located regional educational programs are targeted where this information is delivered to the appropriate county Extension educators so that they become familiar with all the production management aspects for hulless barley. The expected impacts of the program are 1) to educate producers about the hulless barley opportunity, 2) encourage adoption of this new product on a significant number of acres in Virginia, and 3) help growers receive a fair price for the grain by providing research about the feed value of hulless barley to major consumers. The overall outcome goal is to increase the net income of small grain producers in Virginia. For the 2005-2006 growing season, over 1500 Mg of hulless barley has been contracted at a price $16.00 Mg-1 higher than that offered for traditional barley. Hulless barley represents approximately 15 percent of the total barley acres in Virginia.

**Integrated Pest Management**

Many insecticides for soil insects that attack corn are highly toxic and may be removed from the market. Finding lower toxicity and more cost effective treatments has been rated by producers as a high priority. Evaluation of various treatments (pre-existing, new, and experimental) for soil-borne insects that impact the production of corn was conducted. Results were published and data were shared with growers and industry representatives at field days, pesticide meetings, production meetings, and in articles and newsletters. All expected financial and production outcomes were identified and documented. For example, it was discovered through research that cost savings of $3.00 to $4.50 per acre could be realized by using an existing product (Kernal-Guard) rather than a new chemical formulation (imadicloprid). Farmers tend to prefer the newest products on the theory that by being new they are more effective. In this case, the older product was more effective.

**Effects of Tasco(R) Mineral on Reproduction in Beef Cattle Grazing Tall Fescue Pasture**
Research was conducted in cooperation with various private producers throughout the state of Virginia as well as with Virginia State Department of Corrections cattle herds. Twelve hundred spring calving cows were fed a mineral package containing either Tasco seaweed supplement or control. All cows and bulls were fed the mineral for a minimum of 135 days. Cows were pregnancy diagnosed, blood was collected, and hair and body condition scores were determined throughout the study. The results were analyzed for differences and were presented to producers through winter meetings. The data was presented across the state in Extension agriculture agent trainings and in-services. These data will be used to clarify claims made by commercial companies and will allow producers across Virginia and the United States to make educated decisions regarding addition of this mineral to their mineral supplementation program.

**Eastern Tree Fruit Risk Avoidance and Mitigation Program (RAMP)**
This is a four-year project involving tree-fruit researchers and grower cooperators from seven eastern states. The objectives are to develop arthropod pest management programs for pests of apple and peaches that do not rely on the use of conventional pesticide classes and to disseminate this information to growers and Extension agents. Research results have been delivered at trade shows and horticultural society meetings, at in-season, on-farm grower meetings, at professional meetings for entomologists and via newsletters and trade journal articles. Outcomes include demonstration of the effectiveness of new pesticide classes, demonstration of the fit and timing of new pesticide classes in seasonal pest management schedules, increased adoption of alternatives to organophosphate alternatives, reduction in the annual amounts of pesticide active ingredients used in tree fruit pest management, and increased farm worker safety.

**Multistate Research Coordinating Committee/Information Exchange Group, Soybean Rust**
The group developed a 50-page Extension booklet entitled “Using Foliar Fungicides to Manage Soybean Rust.” Additionally a bi-fold identification card guide was produced entitled, “Identifying Soybean Rust.” The group also developed educational and Extension materials and PowerPoint presentations for educating soybean producers, agri-business personnel, county agents, and regulator agents about Asian soybean rust -- its biology, identification, epidemiology, and control strategies. Additionally, we secured 11 Section 18 registrations for each of 22 states and Ontario, Canada. In November 2005, the group co-sponsored, with the American Phytopathological Society, an Asian Soybean Rust Symposium in Nashville, Tennessee to recap the knowledge and experiences gained in 2005. Three hundred fifty-two people were in attendance for the four-day conference. Because Asian soybean rust was not detected in Virginia, the number of acres treated with fungicides was only 38,000 acres out of a possible 510,000 acres. Rust spores were trapped five times during the growing season, but at times of deposition conditions were not favorable for infection. No fungicide applications were recommended. The monitoring of the sentinel plots and surveys confirmed those recommendations. In 2005, Asian soybean rust was confirmed in Florida, Alabama, Louisiana, Georgia, South Carolina, Texas, and North Carolina by surveys and sentinel plots.

*Goal 2: To provide a safe and secure food and fiber system*

**Internet Training Program on Sanitation, and Good Manufacturing and Hygienic Practices for Food Processors, Wholesalers, and Warehouses**

The goal of this project is to integrate research and Extension outreach knowledge from previous food safety programs to develop a national Internet-based distance education training and certification program on sanitation, Good Manufacturing Practices (GMPs), and Good Hygienic Practices (GHPs) for production employees in small, medium, and large food processing, wholesale, and warehouse firms. This distance education program will be available on-demand via the Internet at low cost (estimated at $50.00 or less). Basic worker training is essential to ensure that employee practices consistently and effectively prevent rather than contribute to incidents of finished product contamination in the food handling and processing environment that could cause food borne illness. According to a May 11, 2004, progress review by the Department of Health and Human Services' Food Safety focus area of the Healthy People 2010 initiative, small-scale producers account for only 10 percent of the food supply, but 90 percent of the outbreaks of food borne illness. This training program will particularly benefit small to medium size food processing, wholesale/distribution, and warehouse firms who may frequently have to rely on unskilled workers and experience frequent employee turnover. This project is also timely as it will incorporate any changes associated with the Food and Drug Administration's GMP modernization process. Completion of this modernization process will likely create high interest and a "teachable moment" for many firms. Specific project objectives include: 1) Develop, distribute, and analyze an industry survey designed to obtain information from targeted audiences on how they could best utilize an on-demand Internet training course on sanitation, GMPs, and GHPs, 2) Develop an interactive Internet-based training and certification program on sanitation, GMPs, and GHPs for production employees in food processing, wholesale, distribution, and warehouse facilities, 3) Develop a Spanish-language version of the Internet-based training program on sanitation, GMPs, and GHPs, 4) Develop short topic-specific training modules that these firms can use to conduct additional in-plant training that can be customized to incorporate plant-specific sanitation procedures and employee hygiene and food handling policies, 5) Conduct outreach activities across the United States to inform the target audiences about the new Internet training course, and 6) Evaluate the Internet training course and its impact. This project will be both relevant and timely because of expected changes in the FDA's GMP regulation as a result of the GMP modernization process that the agency has initiated. It is expected that this new Internet course will become available soon after the GMP modernization is completed. The modifications made will be incorporated into this new Internet training program. Because of the modernization of GMPs, the project team also anticipates that industry interest will be at its highest level in recent decades. By starting the development of this new training tool now, the project team plans to be prepared to meet the needs of the food processing, wholesale, and warehouse industries at this "teachable moment." Previous experience with other regulatory programs such as seafood, meat and poultry, and juice HACCP indicates that educators anticipate these "teachable moments" and have effective educational tools such as the Internet course ready when changes in regulations or regulatory policy are completed and announced.

**In-house Composting of Turkey Mortalities: A Rapid Response and Biosecurity Tool for Catastrophic Losses**

In-house composting of catastrophic poultry losses, particularly turkeys, has not been considered a viable option in Virginia because industry personnel and farmers have believed that the composting process would put the poultry houses out of commission for too long and not work on larger turkeys. This study was conducted to simulate a catastrophic loss event. We wished to determine whether turkeys could be composted in-house as a means of disease containment and disposal and to learn the minimum amount of complementary feedstock needed to compost turkeys. The effects of carbon materials, turkey size, and feedstock processing (i.e., whole, shredded, tilled, and crushed) were investigated on a poultry farm in Dayton, Virginia. Eight windrows, each representing a separate treatment, were constructed between December 2004 and January 2005. Two on-farm field days were conducted for poultry farmers and industry service personnel in January and February 2005. Similarly, presentations were given to the Virginia Poultry Disease Task Force, Virginia Poultry Health and Management Seminar, Symposium on Composting Mortalities and Slaughterhouse Residuals, and the Mid-Atlantic Composting Conference. The presentations were also submitted and published in the proceedings. A poster was presented at the National Association of County Agricultural Agents Professional Improvement Conference in July 2005. An article was also written for a quarterly newsletter, *The Spreader*, which was distributed to 1,300 farmers in the Shenandoah Valley. Portions of the work were also incorporated into a CD on Composting Poultry Mortalities that was developed by the University of Delaware and the University of Maryland. Extension guidelines for in-house composting of catastrophic poultry losses were incorporated as an appendix into Virginia's Rapid Response Plan for Low Pathogenic Avian Influenza. In-house composting is an acceptable cost-effective method of disposal and disease containment. In-house composting of turkeys demonstrates that with a good base, cap, and proper disease monitoring, the compost could be turned and moved out of the poultry house within three to four weeks. This time would be comparable to the minimum down time experienced by farmers in the 2002 avian influenza outbreak. Each farm and type of flock would have to be evaluated, but with proper planning and training of farmers and industry personnel, in-house composting is an effective rapid response tool for managing catastrophic poultry losses. Compared to landfill costs, in-house or on-farm composting of catastrophic poultry losses can be effectively accomplished at about one-third to one-half the cost. The results of the research and demonstration are summarized as follows. After two weeks, few carcasses remained in any of the windrow treatments; all four-carbon materials (i.e., hardwood sawdust, woodchips, built-up litter, and starter litter) were effective in composting the turkey mortalities; and, temperatures of all the windrows (at 10 and 30 inch depths) reached 140 degrees and maintained temperatures adequate for pathogen kill.

***Goal 3: To achieve a healthier, more well-nourished population***

**Active Living Every Day**

The Robert Wood Johnson Foundation provides funding to Texas A&M University Health Science Center, School of Rural Public Health to conduct research on how to deliver research-based physical activity programs to large numbers of mid-life and older adults, and to sustain such programs through existing community institutions. The Active Living Every Day Program, designed and tested by the Cooper Clinic, is being tested in various communities for its effectiveness with people ages 50 and up as part of this grant. Patrick County VCE has been

selected to market, implement, and collect and report evaluation data on the Active Living Every Day program as part of this research study. Additionally, VCE has entered into a formal partnership with the Active for Life Center of the National Capital Region with the common goal of increasing the reach of the program after the research study ends. The Active Living Every Day program will be conducted in Patrick County from April to August 2006. Outcome and evaluation data will be reported to the University of South Carolina as specified in the Memorandum of Agreement between VCE and the Active for life Center of the National Capital Region. We expect to receive a compilation of this data by the end of the 2006 calendar year.

**Healthy Weights for Healthy Kids**

Overweight is growing at epidemic rates among American children and adolescents. Conversely, eating disorders are also increasing, particularly among girls. Proper nutrition, physical activity, and positive body image have been shown to be critical for children to achieve healthy weights, in addition to optimal physical and emotional health. Recent research has also documented the relationship between healthy diets and physical activity with academic achievement. Healthy Weights for Healthy Kids is an experiential learning experience in nutrition, physical activity, and body image for children with topics based on emerging trends and research findings. The purpose of Healthy Weights for Healthy Kids is to provide Extension agents and program assistants with a hands-on and user-friendly curriculum that addresses key research-based concepts related to healthy weights. The curriculum is designed to be taught to children between the ages of seven and 14. This age group represents a crucial time to foster healthy behaviors and attitudes to promote lifelong health and positive attitudes. An evaluation tool was developed and tested specifically for this curriculum to determine impacts. Those results are now being aggregated and analyzed. Healthy Weights for Healthy Kids was initially developed and tested with limited-resource youth enrolled in the Virginia Smart Choices Nutrition Education Program (called the Food Stamp Nutrition Education Program in other states) meaning that 50 percent of groups were eligible for free or reduced school lunch. As a result, foods and activities that are described in the curriculum are low-cost and achievable regardless of income level. Evaluation results document the following: 1) Increased knowledge of the importance of nutrition and the Food Guide Pyramid. Children are not eating enough whole grains, fruits, and vegetables and eating too many high fat and sugary items. Only two percent of school-aged children meet the Food Guide Pyramid serving recommendations for all five major food groups, 2) Help children explore ways to enjoy food in moderation. Portion sizes have increased over the past 20 years. Foods offered by fast food chains often exceed the Food Guide Pyramid serving sizes by at least a factor of two and sometimes eight. They tend to be high in fat and sugar. These choices also replace other foods and drinks that are rich in nutrients, like fruits and vegetables, 3) Teach students about healthy drink choices. More and more children are drinking soft drinks or sodas on a regular basis. Non-diet sodas are high in sugar and provide “empty calories,” meaning they don’t contain vitamins and minerals, only calories. They also replace other drinks, such as water, milk, and 100 percent juice, and may reduce their appetite for important foods, 4) Increase awareness of healthy snack options. Children have more access to snack options than in the past, with more vending machines available in schools. Snacks tend to be higher in calories and fat than meals, 5) Expose children to different types of physical activity and emphasize the importance of physical activity for physical and emotional health. Inactivity is common among youth. Nearly half are not vigorously active on a regular basis. The average child or adolescent watches an estimated three hours of television per day (and does not include watching videos or

playing video games). Low levels of physical activity are associated with overweight and poor health, and 6) Improve attitudes and respect towards diversity, including different sized and shaped individuals. A healthy weight is different from one person to another. Children come in different sizes and shapes. Some kids are naturally larger, others small. Many youth are striving to be a size that is unrealistic and unhealthy for their body type. This can lead to low self-esteem and confidence.

***Goal 4: To achieve greater harmony between agriculture and the environment***

**Historical Use of Lead Arsenate on Former Apple Production Areas in Virginia**

Lead arsenate was used in Virginia apple orchards during the first half of the 20th century. It has been estimated that between 1925 and 1945 over 748,000 tons of this chemical were applied to commercial apple orchards in Virginia. This research has focused on documenting the history and measuring soil residue levels across the apple production areas in western Virginia. As a result, a number of publications and public outreach activities will continue to be conducted to offer citizens answers on the potential risks of living on these lands. During 2004 and 2005, research was completed to establish some of the statistics and results that have been communicated to the public through oral presentations. In 2006, several journal articles and Extension publications are planned to further communicate this information. In addition, web-based information will be created and additional presentations will be conducted. Additional funding will be sought to continue the research and outreach efforts. The research being conducted will be published in multiple venues. When this information is published (and disseminated) the potential outcome will be to identify to the public what they can do to protect themselves and to avoid exposure or what to look for when buying lands with potentially high residue levels.

**Pesticide Spray Drift Education**

Pesticide spray drift has the potential to contaminate and damage valuable food and ornamental crops, pollute living areas, and create friction between neighbors. Avoiding pesticide drift near sensitive areas is especially important. The results of numerous spray drift technology studies have been published in a color brochure (14,000 copies) that will be sent to both agricultural interests as well as the general public. Along with the brochure are 5,000 copies of a small poster designed to be put up in central notification areas in agricultural operations, agricultural suppliers, and other related venues. Training materials are being developed to disseminate to Extension agents for use in pesticide applicator training and other related workshops and forums. This information supplements an existing series of drift minimization educational media developed over the past ten years for Virginia Cooperative Extension agents. The Virginia Tech Pesticide Programs website, which reached over 25,000 stakeholders in 2004 and 2005, was revised to target all audiences with drift related information and included the electronic forms of these publications and on-line instructional modules. The expected outcomes are to make people think before they spray or locate application sites near sensitive areas. In addition, we want to make people think when they locate sensitive areas near established application sites. Reduction in drift complaints and clientele feedback are measurable outcomes. Because this is a new activity we will be looking for those outcomes in the future. Immediate feedback from stakeholders has been positive comments regarding their satisfaction that the campaign is in operation.

**Powell River Project**

The Powell River Project conducts research and education programs to enhance restoration of coal mined lands in southwestern Virginia and other central Appalachian areas. We develop research programs to address issues of concern and relevant to the Powell River Project mission, and we conduct education programs to disseminate the results of that research. We maintain a Research and Education Center on mined lands in southwestern Virginia which is used for integrated research and Extension activities. Virginia Tech research, sponsored through the Powell River Project, has developed recommendations for mined land reclamation procedures to be used when reforesting the coal-mined land after mining. These recommendations have been published by Virginia Cooperative Extension. During the year 2005, these recommendations were adopted by a United States Office of Surface Mining (OSM) task force that includes representation from universities (including Virginia Tech) and mine regulatory agencies in nine eastern states, resulting in an OSM publication prepared under Virginia Tech leadership, co-authored by the University of Kentucky's Don Graves, and prepared with involvement by academic faculty in nine states, which describes recommended mine reforestation procedures. The purpose of the publication is to communicate these recommendations to coal-mining firms and to state agencies that regulate and oversee mining and reclamation activities. As impact of Powell River Project mine reforestation research and Extension activities, several Virginia coal companies have modified their reforestation practices. We expect the result to be more productive forests on hundreds (if not thousands) of coal-mined acres in Virginia. The fact that the federal agency task force has adopted these recommendations, and communicated them to the mining industry and state agencies in a publication and through other means, will aide in extending that impact to other eastern coal-mining states.

**Mid-Atlantic Regional Water Quality Coordination Program**

The goal of the Mid-Atlantic Regional Water Quality Coordination Program is to provide science-based expertise and education support needed to ensure that agencies and stakeholders have the most comprehensive and integrated science necessary to reduce nutrient impairments to the waters of the region from non-point sources of pollution. We develop priority regional, science-based educational programs by building upon state programs, developing new regional efforts, and working with other regions and the national water quality program. The clientele for the results of the research activities include federal and state government regulatory and educational agencies, farmers, and private agricultural consultants. Results are delivered to agency staff by serving on technical advisory committees for the Virginia Department of Health (Biosolids Use Regulatory Committee) and the Department of Environmental Quality (Water Reuse Regulations) and by providing regular advice to the Department of Conservation and Recreation for the modification of the Nutrient Management Regulations. Results are delivered to farmers and agricultural consultants by providing both written and electronic educational documents and oral presentations at nutrient management training workshops, and via training of Extension field faculty, who deliver programs directly to farmers. The following activities have been planned and conducted by our Region 3 Water Quality Nutrient Management team to improve understanding and promote adoption of nutrient management planning. Complete the Regional Nutrient Budget: Our team has completed the phosphorus portion of the regional nutrient budget. The development of this information provides a comprehensive, user-friendly, regional web-based database of nutrient surpluses and temporal shifts in nutrient surpluses. This information is being used to shape policy discussions and provide a basis for decision-making on

support programs, incentives, and regulatory actions to address nutrient imbalances. Develop consistent Phosphorus Site Index (PSI) for the region: Our team has collaborated on modifying the phosphorus site indexes developed for each of the Region 3 states to assure consistency among states. This will enable consistency in applying nutrient management planning in the region to ensure water quality improvement and identify opportunities for manure marketing, adaptive management for agricultural producers, businesses and governments, trading programs or other innovative efforts. Rewrite the Chesapeake Bay Nutrient Management Training Manual: The current Chesapeake Bay Regional Nutrient Management Training Manual was last updated in 1995. Since that time there have been substantial advances in our understanding and implementation of nutrient management practices. Rewriting the existing manual, and expanding its applicability to the entire Mid-Atlantic Region has been a multi-year effort with coordination from various researchers, Extension field staff, Chesapeake Bay Program personnel, and other regional stakeholders. We have leveraged funds from both the Chesapeake Bay Program and NRCS to accomplish this project, which also includes the development of training workshops and materials based upon the revised manual. Improved quality of nutrient management training is resulting from this effort.

**Management of *Phytophthora ramorum* in United States Nurseries**

*Phytophthora ramorum* is a devastating pathogen to the natural ecosystems as illustrated in Central Coastal California and Southwestern Oregon. Many ornamental plants are hosts of this pathogen. In addition to suffering direct crop losses due to this Phytophthora disease, the nursery industry has become a primary target that may spread this quarantine pathogen unintentionally due to large number of shipments of plant materials from the West Coast to all over the country. Major accomplishments in this project include: 1) Developed a DNA fingerprinting technique that provides rapid and accurate identification and detection of this pathogen in culture and in plant tissues and 2) Diagnosed over 300 plant samples collected from forests surrounding high risk nurseries and from the Shenandoah National Park in 2004 and nearly 100 samples from the forests again in 2005.

***Goal 5: To enhance economic opportunities and the quality of life among families and communities***

**The Economic and Psychological Determinants of Household Savings Behavior**

Between 1980 and 2001, personal savings as a percent of disposable personal income fell from 10.2 to 2.3 percent. This relatively rapid decline is cause for serious concern. In recent years, doubt has arisen regarding the ability of the Social Security trust fund to pay promised benefits to the soon-to-retire Baby Boom generation. Employers and government have shifted greater responsibility for funding such things as health care and retirement to individual households. Increasingly, households that lack adequate savings can find it difficult, if not impossible, to achieve and maintain long-term financial stability. Without a financial cushion, households have little protection against the adverse effects of income loss due to unemployment, long-term illness, or the disability or death of a primary income earner and may have to rely on extended family or various forms of public assistance to survive. Insufficient savings can also have adverse consequences for the broader economic community. Home or business ownership, important elements in the economic vitality of local communities, are difficult to achieve without savings. In times of economic downturn, loan default or bankruptcy become more likely among

those who have not been savers, shifting the burden of economic loss to the community. Given these concerns, motivating people to save if they are currently non-savers or to increase their level of saving if they are savers, is an important objective. This is the second year of the project. This pioneering research adds psychological and behavioral issues to the study to identify characteristics of people in different stages of saving behavior. We have just received funding for the group to pilot our instrument. Virginia will be part of the pilot. The University of Wisconsin survey research center will perform the phone and mail surveys for all groups. Then focus groups will be conducted with Virginia participants. The revised instrument will be used in a national survey. The results will be used to develop curriculum to help move people from non-savers to savers and encourage savers to save more. Outputs will include: 1) a model that identifies progressive saving stages based on economic, psychological, and demographic factors and 2) the identification of psychological and economic strategies to influence consumers such that they are able to actualize to a higher stage of saving behavior. Outcomes will include: 1) the identification of economic and psychological factors that contribute to increased consumer saving behavior and 2) factors that enable educators to develop educational interventions with consumers to increase their savings. The results of the study including the assessment tool, recommendations for educational curriculum, and recommendations for further research will be made available through journal articles in appropriate journals, conference proceedings, and a special topics pre-conference initiated by the research committee. This ensures that results of the findings will be shared with a large, diverse audience that is interested in savings behavior. Special emphasis will be placed on disseminating the study results and outcomes to organizations and entities with experience and relationships working with underserved communities. Through Extension education and private entities, the technical committee will maximize the dissemination of this information.

**Family Forest Heritage Day**

Although limited-resource landowners own a significant amount of forestland, this demographic has not been well represented at past Extension forestry programs. To research, identify, and address the needs of this clientele group, North Carolina State University invited Virginia Cooperative Extension to participate in a project entitled “Sustaining Ecological and Economic Diversity among Limited Resource Landholders by Expanding Opportunities for Management of Productive Woodlands.” The long-term goal of this research and education project is to strengthen the capacities of limited-resource, traditionally under-served farm and forest landholders throughout the Southeast so that they can sustainably and profitably manage their natural resource base. Research results were delivered to clientele through three workshops in North Carolina and one workshop in Virginia. Overall, 27 landowners attended the program, 78 percent of whom were minorities and/or women. Eighty-three percent of participants responding to the end-of-course evaluation forms indicated that they were very likely to use some of the information presented, while 17 percent said “maybe.” Fifteen participants (56 percent) responded to the six-month follow-up evaluation. Of those, all 15 had shared the class information with family and friends, and 11 had discussed management goals with a professional forester.