2016 South Carolina State University and Clemson University Combined Research and Extension Annual Report of Accomplishments and Results

Status: Accepted

Date Accepted: 06/13/2017

I. Report Overview

1. Executive Summary

Four NIFA high priority issues are addressed in South Carolina's annual report, including Global Food Security and Hunger, Food Safety, Nutrition and Childhood Obesity, and Sustainable Energy. Climate Change is still a priority research issue, but research in Climate Change was moved to the Natural Resources Management Program. This will allow expanded cooperative research efforts with related work underway in Natural Resources. The move will also facilitate the Experiment Station's efforts to cluster related research at the project level.

In addition, the state is reporting on five other priority program areas: Natural Resources Management, Sustainable Animal Production Systems, Sustainable Agriculture Production for (non-food) Horticultural Crops, Community Leadership and Economic Development (now Agribusiness) and 4-H Youth Development. Research and Extension delivery through outreach of research results to the clients promotes the economic growth and development of agriculture and forestry sectors throughout the state.

Work has been underway to implement a group or umbrella approach to research efforts as Clemson research moves away from individual, stand alone projects. This transition was suggested by Dr. Sonny Ramaswamy, Director of NIFA, during his last visit to the university. This will result in a continuing decrease in the overall number of projects and an increase in the opportunities faculty will have for collaboration, innovation, and resource management. The initial results of this transition will be reflected in the Annual Report for FY2017. A significant number of research projects ended in this fiscal year to facilitate the transition and the results generated by the projects is reflected in the individual program narratives.

Extension's Agronomic Crop Production programs impacted the management and production of agronomic crops on over 1,100,000 acres in South Carolina last year. This included all corn, cotton, peanuts, small grains, soybean, sorghum and tobacco. Research and Extension programs addressed issues ranging from proper variety selection to protecting crops from weeds, insects and diseases, new plant varieties, as well as developing more efficient irrigation and harvest equipment.

After a drought-ridden summer, areas in South Carolina were already considered a disaster in terms of the production of certain crops. Many growers estimated at least a 40% yield loss on all crops from the drought alone. Then came the historic floods that occurred in South Carolina in October of 2015. Flooding and continued rainfall that followed the flood event left many producers both unable to harvest crops in the field and plant winter crops. Farm visits and loss assessments were conducted to determine the extent of crop loss present on a farm by farm basis. Appropriate forms and documentation were submitted to agencies requesting data, including FEMA and crop insurance. The exact impact of the flood relief work is difficult to document, due to the unknown value of preventing planting crop losses. Direct crop losses were submitted for producers, allowing producers some assistance through crop insurance and other aid avenues.

The S.C. Pesticide Applicator Training Program is mandated by the Federal Environmental Pesticide Control Act of 1972 and the South Carolina Pesticide Control Act of 1975, as amended in 1978. Farmers and producers of agricultural commodities are required to be trained and certificated in the safe and responsible use of pesticides in order to purchase and apply restricted use pesticides on their farms. In S. C., Clemson Extension provides the training needed to obtain a private applicator license for purchasing and applying restricted use pesticides. Over 97% of those attending Private Pesticide Applicator training

reported knowledge gain. Topics that were covered during the programs included pesticide record keeping, personal protective equipment for safe pesticide application, calibration of liquid and dry pesticide application equipment, and pesticide use in field crops common to the area. Other programs covered common problems of landscape plants for county maintenance staff, nutritional deficiencies from diseases, insect damage and herbicide injury, weed identification, proper selection of herbicides and pesticide applicator safety as part of the SC Nursery and Landscape Association annual Skill Builders series.

Field trials were demonstrated on cotton, soybean, and corn varieties. The area farmers were able to see how different varieties performed under conditions similar to those used on their own farms. Varieties they were not being planted by growers usually outperformed their selections. With yield variances of up to 45 bushels at $4.00/bu that could mean a $180 difference per acre just on making good corn variety selections. In addition, a cover crops field day demonstrated to growers the benefits of cover crops and new irrigation technology. The field day also featured demonstrations of on-farm equipment (a soil moisture sensor and a weather station). Growers were able to see firsthand use of soil moisture sensors, understand the irrigation decision-making with using the sensors, and were able to use localized weather data through Weather Underground. Growers attending the cover crops field day indicated that they were more likely to use less nitrogen fertilizer in the crop following a cover crop. As a result of this program, NRCS applications for assistance in planting cover crops increased from the previous year.

Due to the history of the Sugarcane Aphid, recent infestations, and its migratory pattern through the southeast it was expected that South Carolina would be hit hard with the pest in 2015. Researchers conducted trials to determine most effective chemicals and rates for control. Extension agents scouted many fields for the insect, warned farmers of the danger, and recommended management or spray programs for grain sorghum (either for grain or silage across the state) producers. Once the Sugarcane Aphid hit agents worked with a number of growers on control methods that would help them save or salvage their crops. The new pest infestation has required farmers to spray their fields an additional 1 to 3 times per growing season with an insecticide at a cost of approximately $15-20/acre per spray. The Sugarcane Aphid may increase cost of production by $60.00 per acre or more per year. These increased costs may make the crop less lucrative in the future. As a result the farmers who sprayed in a timely manner and continued the program were able to save their crops from being a total lost. By working with these producers in a timely manner many were able to harvest their crops saving them over $50,000 potential income from the crop.

The Sustainable Horticultural Production Program sought to improve profitability, increase efficiency, and reduce negative environmental impacts of horticultural cropping systems in South Carolina. The economic impact of selected Extension Horticulture Programs was $2,836,000. Extension commercial vegetable production was $235,000, commercial fruit production was $960,000, commercial ornamental production was $500,000, and the Clemson Small Farm Projects was $105,000. The Extension Service can test growers blossoms in strawberry (and now peach as well) to determine the fungicide resistance status of common pathogens. This keeps the grower from using fungicides that are not effective thus saving money, the environment, and improves crop quality and grower profitability.

The Extension Specialist evaluated Pulsators, vacuums, milk lines and inflations for producers. Issues with any of these could cause an increase in somatic cell count and damage to the cow teats and udders. Thirteen milk system checks on seven farms have been performed within a year. Over 500 milking units affecting over 7,000 cows have been evaluated. As a result, producers are able to reduce the chance of losing their quality premiums due to faulty equipment which on some of these farms can amount to the loss of more than $50,000 on some farms.

Hay producers were faced with yet another challenging growing season this summer with hot, dry weather limiting growth in the fields, which led to a delay in cutting and a shortage in supply. Weather extremes caused significant management decisions associated with production. The next challenge hay producers and livestock producers faced was the start of fall with a flood followed by excessive rainfall that had detrimental effects on the already limited hay supply. Hay began to absorb excessive amounts of water leading to some producers having a complete loss of a working supply. Hay stored outside and uncovered was the most damaged; however, this year a unique challenge was presented when some hay storage barns and shelters filled with water. Clemson Extension Livestock and Forages team responded to

this challenge by starting a link on the Extension's Livestock page that allowed hay/livestock producers that had spare hay or hay for sale to list their contact information and the kind of hay they were selling. The Livestock and Forages Team also assisted producers with forage sampling for nutritional and mycotoxin/mold analysis. The workshop offered recertification credits for participants that have private pesticide licenses to ensure the proper and continuous training on how to safely use pesticides for hay production for personal farm use and hay sales.

A 5-week Sire Seminar was developed to prepare producers for the bull-buying season. The course covered selection and evaluation, economics, artificial insemination, reproduction, nutrition, and health. This course was an excellent collaboration of Clemson Extension; Livestock and Poultry Health; Clemson Animal and Veterinary Faculty; and the beef industry. The narrow focus of one animal allowed participants to gain a deeper understanding through thorough presentations and discussion of topics unique to the bull. Two large animal veterinarians received a combined 10 hours of continuing education credit for completing the course. All of the participants reported that Sire Seminar was useful and will save them money. All agreed they would put some of the practices discussed during the seminars to use. Consequently this should translate to an improved beef product from South Carolina. An Equine Forage Management Workshop, coordinated and conducted by Clemson University Extension Service and the NRCS office in Horry County covered topics such as grazing systems, forage management and establishment, fire ant control, high quality pasture production, rotational grazing, manure management, and hay selection. Pre and post evaluations were administered which resulted in 100% of the participants reporting a gain in knowledge.

Extension sponsors Rural Urban Day each May to highlight agriculture in Greenwood County with the help of Greenwood Rotary Club. A farmer is selected to receive the Agriculturalist of the Year award. This year a beef producer won the award. Horse owners learned that they must use good management practices to ensure optimum performance of their horses and also to be good stewards of the land. Composting and forage demonstrations have been implemented as a result of this workshop. Due to the Equine Forage Management Workshop, agents saw a significant increase in soil sampling, weed id, waste management planning, and improved planning for pastures and forage. Livestock producers have a growing interest in planting winter grazing. Many producers in the Pee Dee Region would like to provide grazing for animals while Bermudagrass and Bahiagrass is dormant and improve soil fertility while they provide quality forage(s). Clemson Extension Livestock and Forages Team held a clover/legume field day covering topics such as variety selection, planting dates, soil fertility, weed control, seeding rate, forage quality, and fire ant control. Strips of clover were planted for demonstration purposes and to show the importance of variety selection according to soil type and region. Since the field day there has been an increase in the number of producers planting winter grazing. Producers have also expressed they are having better success by choosing the appropriate variety to match their needs.

Grass Masters, a program developed by the Clemson Extension Livestock and Forages Team, was conducted for local producers to learn more advanced forage management techniques. Grass Masters provided producers with information on forages varieties and production expectation which allowed producers to develop a forage system to provide forage year-around. Producers are provided soil fertility information and how to grow the forages properly. The introduction of grazing management through the Grass Masters program provides advanced concepts to extend the grazing season and get optimum forage utilization. These techniques assist in reducing the amount of stored or purchased feeds and ultimately increases production profitability. This Grass Masters program impacted 3834 acres of managed pasture land. When asked how they plan to use the information producers responded, start a cow herd, improve management of grazing, improve weed control, and plan plantings, improve pastures, strive to get better ADG on cattle, fine tune current practices, better manage pastures and hayfields.

South Carolina Regulation R.61-43 provides requirements for confined animal facilities and the utilization of animal manure from those facilities. Under this regulation, managers of confined animal facilities must obtain a manure management certification through Clemson University and maintain that certification. Trainings were held around the state for reaching 1,663 producers who received certification or recertification. 100% of the participants reported knowledge gained. The first Biannual Confined Manure Managers Conference was conducted by Clemson.

The Livestock and Poultry Health (LPH) division of Public Service Activities at Clemson University is the only National Animal Health Laboratory (NAHLN) in South Carolina. This division is directed by the State Veterinarian and has a team of scientists focused on animal health and regulatory programs. LPH also helps protect the health of SC consumers by providing inspection service to ensure that meat and poultry are safe, wholesome, and accurately labeled. LPH provides many services to all animal producers in South Carolina which includes limited resource producers. Specialists conducted the first Annual CAFLSAVSLPH veterinary conference, which was attended by veterinarians, veterinary technicians and prevet students. Specialists and co-facilitator Mr. John Aucott from USDA Secretary Vilsacks office presented at a meeting of county, state and federal emergency managers in the nuclear industry and American Nuclear Insurers government entities from county, state and federal levels who would be involved in response and recovery following a nuclear incident. Other biosecurity collaborations and presentations to producers have covered topics such as Animal Evacuation, Avian Influenza and Biosecurity, reproductive herd health and biosecurity, an overview of National and MidAtlantic Secure Milk Supply Plans. Specialists conducted SFCP (Scrapie Flock Certification Program) annual inspection of farms.

Specialists gave presentations for the following: the Informatics AVMA section in a Panel Discussion on Veterinary Informatics Core Competencies and Educational Requirements; the NPIP (National Poultry Improvement Program) on Comparison of Operational Plans from the Secure Poultry Supply Plans; the Ag Discovery students and staff about careers in animal agriculture emergency preparedness and response in SC; the National Alliance of State Animal and Agriculture Emergency Programs conference call and the Southern Animal and Agriculture Disaster Response Alliance about C Flooding (Animal and Agriculture Perspective); the SCAV (SC Association of Veterinarians) about VFD (Veterinary Feed Directive) and antibiotics in backyard poultry; the SC Beef Council about the national and state BQA (Beef Quality Assurance) activities, the SC Emergency Management Association(SCEMA) about HPAI response of SC County, state, and county emergency managers; the American Red Cross, DHEC and SC DSS attendees on Planning for Animals in Mass Care; and presented at the National Alliance of State Animal and the Agriculture Emergency Programs Summit on Animal Emergency Response.

The Professional Rain Garden Design and Installer Certification Program is a newly established program. Individuals who attend this training have the option to become a Certified Rain Garden Design and Installer by submitting their rain garden portfolio to an Extension review committee. A Virtual Rain Garden was created to provide a step-by-step approach for rain garden design, installation and maintenance. This series of 17 short videos guides the viewer through all aspects rain gardening including site assessment, soil analysis, rain garden sizing, design, plant selection, maintenance and more. This tool can be used by Extension professionals when answering client calls about flooding and erosion issues in the home landscape or interest in "green" gardening. The Virtual Rain Garden can be accessed, as part of the Carolina Rain Garden Initiative, at (www.clemson.edu/extension/raingarden). The Professional Rain Garden Design and Installer Certification Program is a newly established program. Individuals who attend this training have the option to become a Certified Rain Garden Design and Installer by submitting their rain garden portfolio to an Extension Agents.

Agents responded to questions received from across the nation as an Ask an Expert on eXtension.org, and served as panel guests answering horticulture questions on the award-winning Making It Grow television show. In addition, agents taught and promoted water resource stewardship, litter prevention, and wildlife habitat management.

The Institute for Economic and Community Development staff supported the state and local agribusiness community. An example of this effort is the ongoing Catawba Fresh Market, which allows customers to shop online from local growers. The goal of the program is to provide the best local produce in a convenient and sustainable manner while promoting the success and future of our local agriculture. The development of a local foods system is as much dependent on the education of the consumer as it is on education of the producer. The Pee Dee Food and Farm Guide directly impacts consumer awareness of local agricultural production and is intended to increase consumer demand for scaled up supply. Efforts such as this are just one of the ways that Clemson Extension agents in all program teams are working to plan and develop robust local food economies that capitalize on small farms assets throughout the state.

The South Carolina Women's Agricultural Network (SC WAgN) provided through Clemson Institute for Economic and Community Development continues to grow. The primary purposes of SC WAgN are to encourage and support women in agriculture; provide and strengthen networks for women in agriculture; provide educational and mentoring opportunities for women in agriculture; raise community awareness of agricultural related issues and concerns; and sustain farming livelihoods. The network is comprised of women farmers, agricultural professionals, agricultural educators, and informed consumers committed to supporting and providing educational opportunities to women working in agriculture and ag-related businesses.

Clemson Agents and volunteers conducted 5,433 4-H programs that reached 94,486 youth and family members with programs on agriculture, science and technology, natural resources, food safety and nutrition, and leadership skills. In STEM programs, youth used critical thinking and problem-solving skills. Four youth represented SC at the 2015 National 4-H Conference in Washington, DC. Youth participated in the SC Jr. Beef Round Up. 4H Agents provided 4H Embryology Curriculum and Brooder Equipment for students at schools that was used in classrooms as science school enrichment. A South Carolina team won the National Horse Bowl competition. 4-H Community Gardening efforts alone have impacted almost 3000 youth and families through active participation and community outreach. Youth learned about their communities and were contributing members in them. Youth led and participated in citizenship and service projects. Youth used math skills, critical thinking, and creativity, which are valuable life skills.

In 2011, President Obama signed the Federal Food Safety Modernization Act (FSMA) into law. FSMA is the most comprehensive overhaul of U.S. food regulations to be passed in 70 years. FSMA has the overarching theme of switching food inspection from reactionary to prevention, and it is doing that through a series of five new food safety laws and two new programs implemented over time. In SC, there are approximately 30,000 farmers and food processors that will be affected by one or more of the new FSMA laws. Clemson University is involved in the USDA Southern Regional Food Safety Training Center, which includes 14 Universities and 4 Consumer groups. This Center is focused on meeting the FSMA-educational needs of food processors and farmers. Twelve Clemson Extension employees received training to become FDA-recognized instructors for the FSMA Produce Safety Rule, and we are awaiting approval from the Produce Safety Alliance (funded by FDA) to be recognized lead-instructors to begin offering certification trainings in SC. Three individuals on the Extension Food Safety and Nutrition Program team are lead instructors for FSMA's Preventative Controls for Human Foods (HARPC) law. To date, we have offered one program that certified 25 participants from the food industry to be FDA-recognized Preventative Control Qualified Individuals (PCQIs). As mandated by law, a PCQI must oversee the development and implementation of a food safety plan for facilities that fall within the FSMA regulation. As more staff become certified as lead instructors, more trainings will be held.

SC State Research and Extension Program assisted small minority farmers in retaining their land and increasing their profitability with alternative enterprises. Some of the alternative enterprises included pasture poultry, raising goats, niche markets for specialty crops, such as heirloom tomatoes and pine straw. The Program also promoted healthy living through nutrition and health education and provided youth and family development education programs as well as addressed social, economic and leadership development initiative in communities, especially rural areas. A total of 55 articulation agreements with external agencies were developed for FY 2015 - 2016. Individuals reached through outreach activities totaled 9,560. One thousand four hundred forty-three (1,443) educational workshops were conducted. Twelve faculty members engaged in research through 1890. There were 5 peer reviewed publications. A total of 9 faculty participated in professional meetings with presentations.

The SC State Research and Extension Small Farm Program offered four major Outreach Projects to all farm residents of South Carolina with more emphasis on small scale landowners, limited resources, socially disadvantage farmers and ranchers in South Carolina. The Small Farm Program was implemented in five SC State Extension Clusters and surrounding counties across the state. The four major outreach projects were animal production system, vegetable production system, sustainable agriculture production (IPM) practices and risk management education. The outreach effort addressed landowners, limited resources, socially disadvantage farmers and ranchers needs in South Carolina throughout various educational activities and projects. One of the underlining objectives was to equip all

farmers and more specifically the targeted audience with sound management practices as a must for farming enterprises success and sustainability. The constituents are business men and women and their operations should be considered an integral part of their county or cluster rural economic development.

Within the Small Farm Program, there were 2277 direct contacts made and 1038 indirect contacts with adults. Of youth, there were 412 direct contacts and 100 indirect contacts. Approximately 2146 people participated in the provided workshops. Eighteen hundred participants gained knowledge. There were 2321 acres affected by Integrated Crop Management (ICM). A total of 331 producers agreed to adopt the recommended small farm practices. One hundred percent of the privately owned acres were retained. Livestock producers continued to improve their operation management by gaining improved knowledge and increasing their skills in production, marketing skills and enterprise risk management tools. Despite the adverse climatic and environmental conditions, high feed costs and poor market prices, the producers managed to hold onto their operations. As a result, they became efficient in livestock production management through better production decision making by minimizing their overall production cost. Therefore, the small farmers and producers limited the amount of purchased inputs as much as possible to maintain profitability and minimize any harmful environmental impact.

The Adult Leadership and Community Development Program (now Agribusiness and Community Development) provided communities with leadership training, financial management, business and job development, family and consumer education and child development capacity that created opportunities for continuous and sustained growth. With a focus on resource building, education and training, leadership and organizational development, strategic and sustainability planning, the agribusiness team assisted socially disadvantaged and economically depressed communities in building their potential to enhance their own resource development capacity from the inside out. The activities offered were in community education and outreach. Community education included the SMART Academy summer camps. Community outreach included exhibition booths at the Orangeburg County Fair and the Black Expos held in Columbia and Charleston, SC and the distribution of Community Education One-Pagers. Participation at the county fair was halted due to the impact of the historic flood in South Carolina. However, 573 persons were contacted at the Expos, which included adults and youth. An initiative of Community Development activities began with SC State Extension partnering with Clemson University and Rural Development called Stronger Economies Together (SET) Program. The purpose of SET is to strengthen the capacity of communities/counties in rural America to work together in developing and implementing an economic development blueprint that strategically builds on the current and emerging economic strengths of their region.

The Strategies in Math and Reading using Technology (SMART) Academies used innovative technology of an interactive whiteboard to teach rising third grade students mathematical and reading comprehension standards. A total of 36 youth participated in the Academies (Orangeburg and Charleston Clusters). The students had an exciting as well as educational experience in the SMART Academies. A pre and post test was administered during the program. In reading, 98% of the students increased their comprehension, while 98.8% of the students' math skills increased.

In terms of 4-H Youth Development and Families, the SC State Extension Program promoted an organized extension system that addressed quality of life opportunities for citizens of South Carolina, with a special emphasis on limited-resource communities. Outreach programs and services were provided to constituents in the areas of agriculture/natural resources, family life, health and nutrition, youth development, community economic development, education and technology. SC State Extension delivered more than three projects throughout the 46 counties of South Carolina, reaching approximately 4946 people. Educational workshops were conducted, which totaled 381. Approximately 14 memorandums of Understanding/Agreements were established for the reporting period. A total of 2846 participants reported gaining knowledge from the Healthy Lifestyles Project. The total number reached was a 60% increase from the previous year. Therefore, the Healthy Lifestyles Project made a difference in the lives of the people Extension served. With an intention to increase physical activity and/or reduce sedentary time in their daily lives, 818 people were reported, which was higher from the previous year of 478. Youth participated in 4-H special interest/short term programs for a total of 3649 persons. There were 1138 youth participating in 4-H day camping programs. Of the school enrichment programs, 3442

youth participated.

SC State Research funded five new research projects in 2016. Two of the studies were in the area of Nutrition and Childhood Obesity, while another project was in Natural Resource Management. An additional study was in 4-H Youth Development and Families as well as Sustainable Energy. Because the research was initiated in the later part of the reporting period, little or no data had been collected at the time of the 2016 Accomplishment Report.

In the Food Safety Program, SC State Research had two projects. Research was conducted on ozone treatment as an alternative for conventional fumigation to manage insects in stored products. A year into the project, various lethal ozone concentrations to achieve 100% mortality of life stages for external and internal feeders of insects in stored products were established. Various exposure times at a given lethal concentration to achieve 100% mortality for life stages of external and internal feeders of insects in stored products were evaluated. Eggs, larvae and adults of three external feeders and the same life stages of one internal feeder have been tested thus far. Additional research was conducted on the United States-European Union (US-EU) transatlantic trade and investment partnership: its potential impacts on food safety and SC agricultural production, exports and trade. Surveys were collected from 190 farmers assessing their knowledge of aflatoxins. Out of 190 farmers, 58% reported they never heard of aflatoxins, 26% revealed they somewhat knew about it, while only 16% definitely knew about it. Testing for aflatoxins associated with peanuts and corn on SC farms was conducted. Protocols utilizing ozone as a possible treatment for peanuts and corn containing aflatoxins were developed.

Research in Agribusiness and Community Development consisted of whether the US export credit programs can enhance exporting opportunities and increase income for small agribusinesses and small farmers in SC. The average farm income for a SC small farmer in 2016 was $17,483 per annum. Questionnaires were administered to small farmers and agribusinesses. Two point seven percent of farmers said they export their products. Of the farmers who did not export, only 41.6% wanted to learn about the export market. Ninety-four percent did not know about General Sales Manager (GSM) 102. However, 78.9% were not familiar with the Commodity Credit Corporation (CCC). GSM 102 and CCC were some of the export credit programs provided by the CCC of USDA. Sixty-five point eight percent said they would be willing to participate in a workshop to learn more about the US export credit programs provided by the CCC and explore export opportunities.

Another study in the program area was a data envelopment analysis (DEA) based integrated logistics network system design to improve supply chain efficiency in SC. A new cross efficiency method in DEA for finding the most efficient decision making unit(s) was developed. The DEA to emergency relief supply chain was successfully applied. The emergency relief supply chain design problem was formulated as the multi-objective programming (MOP) model. The new and innovative proposed procedure enabled the researcher to win the Best Paper Award in Application of Theory for the 2016 Northeast Decision Sciences Institute Conference in Alexandria, VA.

Research was conducted on the dynamic linkages among capital investment, export, agribusiness, education, business climate and quality of life variables and economic development of SC. A needs assessment survey was developed to assess the needs for long-term economic viability in Orangeburg, Bamberg and Calhoun counties, which have higher unemployment and poverty rates.

Additional research was conducted on accelerating the usage of digital communication technologies by small agribusiness firms in SC. Data was collected on 1500 small agribusinesses, which provided information related to small business web and social media presence in SC. The data suggested 31.3% of small agribusinesses had a website to market their products. However, only 28% of the websites had e-commerce capabilities. The researchers conducted 21 semi-structured interviews with a variety of agribusiness operators to understand the challenges related to adoption of digital platform for marketing. All interviewees cited the lack of technological skills and unavailability of affordable external assistance as the two major barriers. To increase the internet presence of small agribusinesses, the research team established an Ag-Business Digital Media Integration (DMI) Lab. A project website was created to increase awareness about the DMI Lab. Three small businesses were assisted in improving digital engagement through website creation, Search Engine Optimization (SEO) and social media integration.

SC State Research examined the reduction of transient instability related power blackouts to lessen the crops and livestock losses by US farms and the spoilage of refrigerated agricultural products. Transient instability is a major cause of power blackouts that have devastating effects on US farms in terms of significant losses of crops and livestock and substantial spoilage of refrigerated agricultural products. Mathematical formulations were developed as well as computer programs. The programs were verified, tested and modified. The programs were needed to investigate real-time local control of transient instability by the proposed technique using different local control means.

The last study under the Planned Program was transferred from the Sustainable Animal Production Systems at the suggestion of the USDA Liaison. The project focused on preventing the effects of noise induced hearing loss and high blood pressure among SC farmers and agricultural workers. Farmers were contacted to complete surveys to determine their exposure to noise. Informed consent forms were obtained for farmers to participate in the project's second phase, which would assess the exposure of farmers to noise levels with farm equipment. Educational materials and a PowerPoint presentation was developed for local and state fairs as well as workshops and community events. Specifications for a customized mobile van unit were created. The van was delivered to a specialty vehicle company to be up-fitted. Once the van has been returned, pertinent data will be collected and disseminated to communities of interest.

In the 4-H Youth Development and Families Program, research was conducted on challenging and encouraging African American males to be successful in mathematics. An average of 9 participants from each of the 4 participating middle schools were selected to participate in the study. A 2 week non-residential summer enrichment program was held and a pre-test administered. Each participant was assigned an iPad Mini for instructional purposes. Real-world applications and problem solving was essential to each lesson. A post-test was given. Mathematics scores increased by 25% of the participants.

More research was studied assessing the degree of developmentally appropriate assessment, curriculum and best strategies utilized by community based child care center based programs. Developmentally appropriate instructional practices were inconsistently used because the majority (over 50%) of the learning experiences were (1) teacher-centered, (2) large groups and (3) focused on worksheet exercises or uniformed learning assignments. The centers examined in the study showed 62% of the time teachers were talking, while only 35% of the time children were talking with the remaining 3% undetermined. Large group times predominated the regular school day relative to the number of small group learning experiences. Pre-fabricated worksheets and uniformed assignments (i.e., making a "B" Book) were the focus of 72% of small group times. Developmentally appropriate curriculum that were not predominately used for the majority were based on (1) worksheets, (2) a mix of in-determinant parts of other commercial curriculum and (3) a lack of systematic curricular evaluation process of any kind. A major problem was the lack of a systematic way to evaluate the appropriateness or effectiveness of the curriculum with some curriculum being in use for years without any notion of reviewing it for relevance or obsoleteness.

Under the Nutrition and Childhood Obesity Planned Program, research was explored on reclaiming a healthy heritage. The project created experiences for stakeholders to become more aware of childhood obesity. To help combat childhood obesity, a variety of activities, lessons and field experiences were presented to faculty, staff and students at the Child Development Learning Center on the campus of SC State University. The activities included planting a garden, learning about locally grown foods and how to prepare the foods. The lessons were nutritional in content and introduced children to a variety of fruits and vegetables. The field experiences centered on gardening, production, preparation and consumption. The exploration of farm life was to gain knowledge on how some of the foods consumed got their beginning. In addition, a monthly nutritional newsletter was distributed to the students. Inside each child development classroom, the students utilized nutritional learning tools such as a gardening stand along with the associated foods, portion controlled dinnerware, grocery bags and lists and iPads to interact with nutritional games. Nutritional cards, shopping bags, MyPlate portion controlled cups, plates and silverware and cookbooks were given to students to take home for extended use and learning. Continued support from parents would help to manage childhood obesity as literature was made available. The project

produced a Food and Nutritional Lesson Plan Booklet to serve as a curricular supplement in the early childhood setting.

An additional study examined the reduction of cancer risk caused by obesity and metabolic syndrome: inhibition of Insulin-like Growth Factor (IGF)-1 receptor signaling. The concurrent use of small molecule inhibitors to achieve cancer cell growth inhibition and apoptotic activity was determined. The experiments were completed and the results showed significant cell growth inhibition as predicted, but moderate restoration of apoptotic activity using methodology adopted. Results also showed cancer cell lines used (two pancreatic carcinomas and one lung cancer) showed a spectrum of dependence on (GF-1 for tumorigenic activity, as evidenced by their sensitivity to the inhibitors used. Through the publication of the completed experimental data, the cancer research community will get a better understanding of how specific small molecule inhibitors can be used in cancer therapy and how they affect different types of cancer in laboratory experiments. Current project results showed concurrent use of inhibitors on one signaling pathway had significant therapeutic value and the effect was different for different types of cancer. Further experiments could be based on the knowledge gained to improve strategies used in targeting signaling pathways in cancer therapy.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	135.0	41.0	23.1	13.0
Actual	138.0	41.0	42.0	13.0

II. Merit Review Process

1. The Merit Review Process that was Employed for this year

- Internal University Panel
- External Non-University Panel
- Expert Peer Review
- Other (Research Results Reviewed by selected growers and commodity groups and associations)

2. Brief Explanation

The Research and Program Development Committee of the South Carolina State Extension Advancement Council reviews and comments on new programs initiated by Clemson University and South Carolina State University. The Council meets 3-4 times a year. The seven-member Research and Program Development Committee is one of the Council's three committees that review the list of programs and descriptions annually. The committee serves as the external non-university panel for program review. The committee members have participated in Extension programs, are knowledgeable of South Carolina's social and economic demographics, and are sensitive to the needs of underserved and underrepresented populations. The total Council, which is composed of Extension volunteers, producers, forestry consultants, a community center program coordinator, public school educators and business owners (bank, funeral home, insurance, lawn care), has the opportunity to give input about programs.

There are internal university review panels at both Clemson and South Carolina State. The programs

are reviewed by State Extension Program Team Leaders and by administration, at each institution. Both panels review projects and programs at their institutions based on organizational capacity, relevance and impact. The internal university panels are asked to review annually South Carolina's Plan of Work. The Research and Program Development Committee is kept abreast of national program areas and the realignments of research and extension activities at both institutions. The program review activities of the committee complements the scientific peer review process established at both institutions.

An internal review panel meets to review all research outputs and outcomes with faculty members in preparing to initiate new research projects. The review panel consists of the Experiment Station Director, the Associate Dean for Research and Graduate Studies, the Department Chair of the PI, a member of media services, and other subject matter experts as needed. The panel is appointed by the Experiment Station Director in consultation with other administration, faculty and staff. The panel reviews all pre-proposals submitted for new projects to ascertain the merit of the project and to assure that it fits the overall goals and objectives of the Experiment Station and the College. The panel also reviews the full proposals along with external reviewers' comments and the final proposal before submission to NIFA in Washington, D.C. This panel also reviews the outcomes and outputs from each project when annual and final reports are submitted. A project termination meeting is held at the conclusion of the project to discuss the project and determine the next steps for a new project. In addition, all research projects go through a review process as outlined under Hatch or Evans-Allen regulations. This serves as the Expert Peer Review process, as each project is sent for external review, comments and suggestions, which are examined and incorporated into the new project, as appropriate**.**

III. Stakeholder Input

1. Actions taken to seek stakeholder input that encouraged their participation

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey specifically with non-traditional groups

Brief explanation.

Stakeholder input remains a key to successful Extension programs. Input is shared with research faculty to assist in determining research priorities. Clemson and South Carolina State Universities have a long history and tradition of seeking stakeholder input into the Plan of Work process. The process of seeking stakeholder input includes identifying stakeholders that should have input in the POW process and determining the process used in seeking stakeholder input. Groups understand that their input is valued and will be followed up. Invitations are usually mailed to groups that participate in our programs. Traditional and social media are used to invite the general public.

2(A). A brief statement of the process that was used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups
- Open Listening Sessions
- Needs Assessments
- Use Surveys

Brief explanation.

Extension partners with agencies and organizations that serve non-traditional audiences, which include low-income, non-Anglo, etc.). Individuals who are involved in the Research and Extension Programs and/or receive services as well as persons who may have an interest or concern are identified and contacted. Stakeholders are identified and invited to attend meetings. Stakeholders included those internal to the Cooperative Extension System--administrators, extension agents, agent professional associations, specialists, faculty, department chairs, associate deans and faculty, as well as, those external to the system. External stakeholders are Extension advisory board members, commodity group representatives, community leaders, human service providers, business/industry representatives and collaborators (Farm Bureau, Chamber of Commerce, Farm Service Agencies, etc). Representatives from all audience groups are invited to county and local advisory meetings to collect input.

2(B). A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Meeting specifically with non-traditional groups
- Survey specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public

Brief explanation.

The most recent process used in collecting stakeholder input included regional meetings that were held with representatives from all counties in the state to identify issues and set priorities for agricultural research and Extension. In addition, a Customer Satisfaction Survey was administered to collect data from citizens who have received services sponsored by the Extension Service. The goal was to help county staff and administrators find ways to improve program quality, information delivery, and to assist in the accountability process. Commodity groups, the SC Farm Bureau, the Department of Natural Resources and the State Department of Agriculture as well as individual growers and producers are in on-going dialogues to identify issues and make decisions on the use

of available research resources.

3. A statement of how the input will be considered

- In the Budget Process
- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans
- To Set Priorities

Brief explanation.

County data are compiled from stakeholder meetings and the information is used to make recommendations and adjustments in Extension program design and implementation as well as research initiatives. The Customer Satisfaction Survey report was shared with Extension administrators, State Extension Advancement Council members and the Extension system. In general, respondents felt Extension was a valuable service and a great use of public funds. Clientele expressed that they wanted more affordable and better publicized training sessions.

Brief Explanation of what you learned from your Stakeholders

In general, respondents felt Extension was a valuable service and a great use of public funds. Several comments reflected the wishes of clientele to have an agent assigned to their county and to have more access to an agent or Extension information.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
5856616	1870988	4378809	2290646

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	5396118	1870988	4511667	2290646
Actual Matching	5396118	1534034	4937484	1874930
Actual All Other	0	0	15069201	0
Total Actual Expended	10792236	3405022	24518352	4165576

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	4537330	0	132858	0

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Sustainable Animal Production Systems

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
301	Reproductive Performance of Animals	10%	20%	37%	0%
302	Nutrient Utilization in Animals	15%	20%	0%	0%
303	Genetic Improvement of Animals	15%	15%	0%	0%
305	Animal Physiological Processes	5%	0%	0%	0%
306	Environmental Stress in Animals	5%	0%	0%	0%
307	Animal Management Systems	15%	20%	18%	0%
308	Improved Animal Products (Before Harvest)	10%	15%	18%	0%
311	Animal Diseases	5%	0%	9%	0%
312	External Parasites and Pests of Animals	5%	0%	0%	0%
313	Internal Parasites in Animals	5%	0%	0%	0%
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	5%	0%	0%	0%
315	Animal Welfare/Well-Being and Protection	5%	10%	18%	0%
	Total	100%	100%	100%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	10.0	8.0	2.8	3.0
Actual Paid	20.0	8.0	3.5	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
718700	325040	526586	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
718700	266489	289951	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	526586	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Clemson Extension activities included Southern Forages Seminar, Equine Forage Management Workshop, Hay Production Field Day, Sire Seminar, artificial insemination certification for beef and dairy cattle producers, Master Cattleman, Grazing Management, Grass Masters, Small Ruminant Management, Backyard Poultry, Animal and Agriculture Flooding, Pork Quality Assurance trainings, Economic Impact of Livestock to Counties, biosecurity programs, meat goat workshops, and quality milk initiative assessments.

Results from research on toxic and non-toxic fescue will allow beef cattle producers throughout the region to make more informed decisions during the breeding season. Specifically, data will allow producers to convert appropriate acreage from toxic to nontoxic fescue to optimize reproductive rates. These results should make a significant impact on beef cattle profitability as well as decrease the need for toxic pasture conversion thereby decreasing fuel, seed and tillage inputs as well as decreasing risks of soil erosion.

The impact of research conducted on pigs will affect animal health across species and may allow for the development of more accurate commercial testing for porcine reproductive and respiratory syndrome (PRRS) virus and possibly other infectious agents present in livestock. The goal of these studies is to develop strategies to mitigate the negative effects of the toxin on male reproduction and increase production efficiency within the affected region.

A three year study assessing bull fertility when grazing toxic fescue noted that no decrease in fertility was detected due to grazing toxic tall fescue when semen was fresh-extended and used in timed-insemination.

A Universal Self-Amplified biosensor circuitry has been developed and evaluated. Individual biological components of the circuitry were designed and assembled using standard BioBrick assembly methods. The inclusion of a self amplification module in the biosensor design should greatly enhance the detection limits and further shorten the time required for detection of target microorganisms in animals.

The small farm program livestock production project was designed for all farmers, but more specifically socially disadvantaged small, limited resource producers owning and/or raising beef cattle and meat goats. The focus was on farm/enterprise management, production and marketing and providing training sessions, workshops and demonstrations to deliver research based information.

2. Brief description of the target audience

Producers, Limited-Resource Farmers and agency personnel, etc.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	21596	4288	199	50

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2016
Actual:	1

Patents listed
Method of Sampling a Mammalian Tissue as a diagnostic tool

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	1	8	9

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Disclosures

Year	Actual
2016	0

Output #2

Output Measure

- Licenses
  Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Number of people completing educational workshops.

Year	Actual
2016	9068

Output #4

Output Measure

- Number of educational workshops conducted.

Year	Actual
2016	514

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of people reporting increased knowledge and indicating adoption of animal production practices.
2	Number increased percentage of forage fed beef production in the State and Region
3	Increased income due to producers and growers improved production efficiency of confined animal systems.

Outcome #1

1. Outcome Measures

Number of people reporting increased knowledge and indicating adoption of animal production practices.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	964

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Livestock producers were interested in Farm Service Agency programs that help protect them from grazing and hay losses due to unfavorable growing conditions. The lack of available grazing and hay would cause producers to purchase additional feed, which would reduce profit.

What has been done
Workshops were conducted with representatives from the Farm Service Agency (FSA) to discuss the Noninsured Crop Assistance Program (NAP) for pastures and hayfields as well as Livestock Forage Disaster Assistance Program (LFP) for livestock producers.

Results
Over 40 producers participated in the workshops. Ten producers enrolled in the NAP program and producers in all counties except Saluda were eligible to sign-up for the LFP due to the drought. Improvement was made on operation management by gaining knowledge and increasing their skills in production, marketing skills and enterprise risk management tools. Despite the adverse climatic and environmental conditions, high feed costs and poor market prices, the producers managed to hold onto their operations. As a result, they became efficient in livestock production management through better production decision making by minimizing their overall production cost. The small farmers and producers limited the amount of purchased inputs as much as possible to maintain profitability and minimize any harmful environment impact.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals

303	Genetic Improvement of Animals
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)

Outcome #2

1. Outcome Measures

Number increased percentage of forage fed beef production in the State and Region

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Increased income due to producers and growers improved production efficiency of confined animal systems.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2604774

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Sustainable Animal Production Systems program aims to improve the production efficiency, environmental sensitivity, and profitability of animal production systems and reduce the environmental impact of animal waste in South Carolina. In addition, South Carolina has approximately 91,900 cattle grazing wild-type infected tall fescue each year; however, a toxin producing endophyte significantly decreases conception rates in beef cows. Cattle removed from toxic tall fescue immediately prior to and during the breeding season had 40% improvement in conception rate.

What has been done
In 2016, Clemson Extension hosted an intense 3 day artificial insemination certification for beef and dairy cattle producers. The training highlighted advantages to using artificial insemination (AI) in beef/dairy cattle herds and showed how to implement AI for individual operations, including protocols for estrous synchronization, and information from a cattle-breeding service on cost per

service for using AI. Over 90% of the participants indicate adoption of estrous synchronization and AI. In 2016, producers attending the class represented an estimated 3,500 head of cattle. In addition, Extension programs targeted conversion of toxic tall fescue stands to novel (non-toxic) fescue, or dilution of these effects through proper management considerations. Using current market prices, calves (600lb) are worth $660 at weaning.

Results

Artificial insemination and estrous synchronization will lead to increased weaning weights, increased pregnancy rates, increased net worth of the cow herd, and lower retention of replacements. Considering all of these factors, an estimated $75/cow economic impact can be calculated on these operations. (3,500 cows multiplied by $75/cow=$262,500 for this one program.) In addition, the Extension service strives to achieve a 10%/year adoption rate of best management practices for raising cattle on toxic tall fescue. Considering this adoption rate, Extension programming would have a yearly impact of $2,604,774 to the beef industry in SC.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
305	Animal Physiological Processes
306	Environmental Stress in Animals
307	Animal Management Systems
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
315	Animal Welfare/Well-Being and Protection

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

After a drought-ridden summer, areas in South Carolina were already considered a disaster in terms of the production of certain crops. Many growers estimated at least a 40% yield loss on all crops from the drought alone. Then came the historic floods that occurred in South Carolina in October of 2015. Flooding and continued rainfall that followed the flood event left many producers both unable to harvest crops in the field and plant winter crops.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Over 93% of the participants in animal related Extension programs reported knowledge gained. Producers reported improved breeding, health and reproduction methods, and implemented recommended grazing management systems. Programs increased market awareness and marketing strategy.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Sustainable Agriculture Production for (non-food) Horticultural Crops

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
111	Conservation and Efficient Use of Water	10%	0%	10%	0%
204	Plant Product Quality and Utility (Preharvest)	0%	0%	10%	0%
205	Plant Management Systems	10%	0%	20%	0%
211	Insects, Mites, and Other Arthropods Affecting Plants	20%	0%	40%	0%
212	Pathogens and Nematodes Affecting Plants	20%	0%	0%	0%
213	Weeds Affecting Plants	10%	0%	0%	0%
215	Biological Control of Pests Affecting Plants	5%	0%	0%	0%
216	Integrated Pest Management Systems	25%	0%	20%	0%
	Total	100%	0%	100%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	15.0	0.0	5.0	0.0
Actual Paid	18.0	0.0	5.8	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
657023	0	861266	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
657023	0	756465	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	2185106	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Extension horticultural programs were conducted such as pesticide applicators recertification, turf management, managing insects and diseases on plants and trees, spreader calibration, fertilizer applications for nurseries and landscapes, and fire ant management. Ask-the-Expert exhibits during the SC State Fair and at Farmers' markets, allowed agents to be accessible to the public to answer specific questions pertaining to landscapes and gardens. Agents also conducted plant problem clinics, Brown Bag Lunches and other educational programs on Sustainable Landscaping for Homeowners, Habitat Diversity, Pollinator Awareness, and Lawn Care. Agents developed and delivered a lecture series on the Sowing & Growing Fundamentals of Gardening and a series of turf lectures. A Certified Landscape Professional online certification program was developed and implemented. Agents conducted workshops during trade association conferences, Turf School, the Carolina Golf Course Superintendents Association regional conference, and Cultivate 2016 sustainability conference.

Agents hosted the Making It Grow live television show to address consumer horticulture questions and hosted the call-in radio program, Your Day, to answer plant problem and landscaping questions. The Home and Garden Information Center (HGIC) website recorded 3,931,758, hits last year. HGIC updated 183 fact sheets and created 11 new fact sheets.

Causal agents of spring dead spot were proved to be wholly caused by Ophiosphaerella korrae in South Carolina by surveys of affected golf courses.

Good control of spring dead spot in bermudagrass greens was achieved with certain new fungicides (pyraclostrobin + f luxapyroxad; penthiopyrad; several experimental not yet registered). This result was timely due to the voluntary withdrawal of fenarimol (Rubigan) from the market.

Research indicates that zoysiagrass golf greens, compared to the more traditional bermudagrass or bentgrass, have the advantages of having better shade tolerance, heat tolerance, disease tolerance with less problems with low temperature kill, remain green for longer periods throughout the year, and is a durable grass compared to the traditionally used species

Research was also initiated on testing the physiological effects of using various dyes, oils, and pigments on creeping bentgrass and hybrid bermudagrass. Claims are being made these products improve stress tolerance of turfgrasses. After intense investigations, many of the claims by manufacturers have not been realized by this research, saving end users considerable dollars by avoiding these products which mostly do not perform as advertized. Research along this line was expanded to also include bermudagrass. Similar findings occurred for bermudagrass as bentgrass. Not only do products "clog" stomates, reducing transpiration, they also reduce the amount of sunlight received by plants. Being C4 plants, this reduces the competitive growth of bermudagrass, increasing maintenance costs in terms of increased disease pressure and possibly having to replace weakened grass.

Researchers are working to develop a cost-effective, efficient, and environmentally sustainable water treatment system beyond those chemically-based systems currently in use. Work is ongoing to

identify vegetation and substrate-based treatment technologies that can be paired effectively with altered production practices to remediate nutrient and phytopathogen contaminants

2. Brief description of the target audience

The audience will include producers, small farmers and Extension personnel, horticulture professionals, residents in counties with Master Gardener programs, Master Gardeners, and consumers.

3. How was eXtension used?

Agents answered questions through eXtension related to landscaping and plant problems.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	18789	1692	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2016
Actual:	4

Patents listed

1.System for Plant Development. 2. Methods and Compositions for transgenic Plants with Enhanced Cold Tolerance, ability to Flower Without Vermalization Requirement and Impacted Fertility. 3. Methods and Compositions for Modulating Gene Expression in Plants. 4. Plant Propagation System and Method

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	2	17	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Disclosures

Year	Actual
2016	1

Output #2

Output Measure

- Licenses

Year	Actual
2016	0

Output #3

Output Measure

- Number of people completing horticultural educational workshops

Year	Actual
2016	7449

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of participants gaining knowledge and applying skills learned in environmental horticulture education.

Outcome #1

1. Outcome Measures

Number of participants gaining knowledge and applying skills learned in environmental horticulture education.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	7175

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Sustainable Agriculture Production for non-food horticultural crops program at Clemson University seeks to inform horticulture professionals and consumers on environmentally sound horticultural practices that will improve communities.

What has been done
Extension provided over 266 educational programs to horticulture professionals and consumers to help them improve their homes and communities through the use of environmentally sound horticultural practices. Approximately 40,000 acres of sod were affected. Assistance was offered to nurseries and floriculture producers.

Results
Over 95% reported knowledge gained. There were 76 joint educational efforts with industry, state or federal agencies and/or trade associations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

After a drought-ridden summer, areas in South Carolina were already considered a disaster in terms of the production of certain crops. Many growers estimated at least a 40% yield loss on all crops from the drought alone. Then came the historic floods that occurred in South Carolina in October of 2015. Flooding and continued rainfall that followed the flood event left many producers both unable to harvest crops in the field and plant winter crops.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Ninety-five percent of the people participating in Extension programs indicated that they gained knowledge.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Natural Resource Management

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
111	Conservation and Efficient Use of Water	10%	0%	17%	25%
112	Watershed Protection and Management	10%	0%	33%	20%
123	Management and Sustainability of Forest Resources	35%	0%	32%	10%
124	Urban Forestry	5%	0%	0%	0%
131	Alternative Uses of Land	0%	0%	0%	30%
133	Pollution Prevention and Mitigation	35%	0%	9%	10%
135	Aquatic and Terrestrial Wildlife	5%	0%	9%	5%
	Total	100%	0%	100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	18.0	0.0	5.0	1.0
Actual Paid	12.0	0.0	8.4	1.0
Actual Volunteer	11.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
440721	0	420304	89944
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
440721	0	824483	73622
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	3002076	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Findings suggest that prescribed burns overall reduce the export of dissolved organic carbon compared to an unmanaged site. However, the season of prescribed burn did not make a difference.

Data also suggests that the biodegradable dissolved organic carbon in thermally derived dissolved organic matter decreases as fire intensity (i.e., temperature) increases. Post-fire algal blooms can increase chlorine reactivity of fire-affected terrestrial dissolved organic matter.

Research has determined that saltwater intrusion into isolated coastal freshwater wetlands will likely affect carbon budgeting by shifts in vegetation dynamics, as well as by indirect shifts in groundwater hydrology, providing a framework for assessing dissolved carbon and nitrogen fluxes from these wetlands.

Research has illustrated how the balance between opposing forces of elevation gain and elevation loss are important in determining the overall resilience of a wetland system. Documentation was provided of the critical role of hydraulic connectivity between stream flow and depositional floodplain areas in maintenance of water quality.

Results from research on storm water management practices indicated higher coliform bacteria discharge from the natural systems (forest and wetland), while retention-based pond and pond/wetland systems were significantly lower.

Significant progress was made to identify and test novel sensing devices to monitor environmental water quality and quantity relationships, to develop methodologies and hardware to enable efficient sensor deployment in aquatic and terrestrial environments and to deploy and evaluate water quantity and quality sensors in a spatial framework informed by high resolution remote sensing derived datasets.

Agents conducted fire assessments, and presented workshops on prescribed fire burning, timber taxation, wildlife and pond management, hunting and land liability, forest landowner association meetings, and worked with individual families. Water Resources programs included presentations at USEPA Denver office to illustrate the benefits of fuel reduction techniques on wildfire and water quality improvements, Carolina Yards certification program, storm drain marking programs, Master Pond Manager Online program, Build Your Own Rain Barrel program, Shorescaping Workshop, Post-Construction BMP Inspection Course, From Seeds to Shoreline Program, and Rain Garden Programs. Water Resources Extension Agents led workshops and trainings on how to install a variety of stormwater best management practices (including floating wetlands, wetland carpets, vegetated shoreline buffers, rain barrels, rain gardens, pollinator gardens, and bioretention) for a variety of audiences (including residents and homeowners, public works staff, engineers, county and municipal officials, landscapers, and homebuilders). Trainings involved teaching the fundamentals of the practice, and then participating in an installation of a best management practice. Clemson was one of the states included on a grant that was submitted to NIFA on County Level Economic Impact Training in Forestry and Climate Learning Network - Climate Masters Program. Six e-learning modules were developed and are made available at this website: at <http://www.climatelearning.net/e-learning-modules/>.

The water project team maintains and shares relevant information on various Clemson-hosted websites and Facebook pages. Focus groups and surveys are conducted regularly to determine community attitudes, which are then targeted using statewide commercials, community segments, spots on television programs such as Making it Grow, YouTube videos, and SC waterways factsheets.

Research is being conducted on applying Instrumental Neutron Activation Analysis (INAA) to the study of toxic trace elements in cotton seeds. By analyzing cotton seeds and the corresponding local soil with INAA, it is possible to determine the level of trace elements with high accuracy and extreme sensitivity and establish a relationship between the amount of toxic trace elements in the cotton seeds and the level of heavy metal contamination in the local soil. The research is in its initial stages of the project. Cotton seeds and whole cotton plant samples in Orangeburg County were collected. Conducted a pilot study at NCSU; trained students for INAA theories, which included sample collecting and preparation, took a field trip to Savanah River and established a website for NAAS.

2. Brief description of the target audience

The target audience includes farm and forest landowners, Extension agents, and administrators, natural resource professionals, land management agency personnel and user groups and nature-based tourism operators/industry. It also includes South Carolina citizens, tourists, children in school, after-school, summer and 4-H programs, agents and volunteers, urban, suburban and rural residents, farmers, ranchers, poultry and swine producers, foresters, urban agents, agency personnel, urban planners and land owners/managers, municipal officials, and local community groups statewide, government officials and recreation and tourism operators.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	16396	1527	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total

Actual	0	23	23

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Disclosures

Year	Actual
2016	0

Output #2

Output Measure

- Licenses

Year	Actual
2016	0

Output #3

Output Measure

- Number of people completing educational workshops.

Year	Actual
2016	13338

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of people gaining knowledge and using practices to improve water quality and quantity.
2	Number of people applying wildlife habitat improvement practices.
3	Number of acres affected by sustainable forestry practices.

Outcome #1

1. Outcome Measures

Number of people gaining knowledge and using practices to improve water quality and quantity.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	10358

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Continued and rapid development across South Carolina is stimulating rapid land-use change, with many natural or otherwise pervious surfaces transitioning to impervious cover, which contributes to the flashiness of the watershed, increases the volume of stormwater runoff, and ultimately provides a conduit for carrying land-based pollution downstream where it affects receiving waters. As a result, stormwater runoff is the greatest threat to water quality in South Carolina, and more than 1150 of SC waterways have been classified as "impaired," which means they are too polluted or degraded to meet accepted water quality standards. Because all SC residents contribute to stormwater pollution, educational efforts targeting behavior change across a variety of audiences is essential to realizing improvements in stormwater quality and quantity.

What has been done
Agents taught a variety of technical programs including sediment and erosion control (Silt Fence and Beyond), watershed-friendly landscaping (Carolina Yards Online course), pond management (Master Pond Manager), rain garden workshops, rain barrel workshops, shorescaping workshops, septic maintenance workshops, water quality monitoring (Adopt a Stream trainings), introduction to Low Impact Development, and a stormwater pond conference to provided education and public involvement opportunities to install stormwater best management practices that function both as teaching and demonstration sites for the public, as well as sites for improved infiltration and water quality improvement and developed technical programs targeted at a variety of audiences, including engineers, developers, home-builders, landscapers, construction site contractors, homeowners associations, planners, and landscape designers. Over 68,000 people were reached through online content, and over 4.9 million people were reached through television commercials and appearances. Volunteers and agents worked at the SC State Fair for Ask an Expert activity. Appearances were made on the Making It Grow TV show to discuss water quality tips. Agents led stream cleanups with volunteers and taught Protecting Water Quality from Curbs to Creeks. Attendees were given reusable lids to encourage proper disposal of fats, oils, and grease.

Results
Over 99% of the participants gained knowledge. Stream clean ups resulted in the extraction of 65 bags of garbage, and other debris from one stream, 2,000 pounds from another stream and trail, and 357 pounds from another trail system. Seventy (70%) of participants thought the information they gained would help save money on their job sites. Participants plan to use the information learned in future inspections, to improve erosion control on ditch banks, to train employees, make better decisions in the field, and prioritize erosion control. Over 45,000 square feet of stormwater best management practices were installed to treat and infiltrate stormwater runoff across South Carolina.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
131	Alternative Uses of Land
133	Pollution Prevention and Mitigation

Outcome #2

1. Outcome Measures

Number of people applying wildlife habitat improvement practices.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1418

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Over three-fourths of the wildlife habitat in South Carolina is owned by private landowners, primarily forest and farm owners; consequently there is an information need related to managing wildlife on these lands in order to create and maintain ecologically significant habitats in and around urban areas as traditional wildlife habitats are lost. Wildlife and human conflicts are a major issue in South Carolina and will continue to pose significant economic and human health risks as the state becomes more developed. An educated clientele is important in trying to find a balance between sustainable natural resource management and development in the state.

What has been done
Educational efforts included workshops on establishment of habitat for native pollinators, wildlife habitat improvement plan, Wild Hog Control Workshop, native warm season grasses webinar, feral swine control training, phragmites control meeting, invasive species outreach program, deer management training, coyote management workshop, prevention and control of wildlife damage, Waterfowl and Wetland Wildlife Management workshop, and Fire Ant Management in-service training. A grant was completed to assess effectiveness of repellents on reduction of deer damage to soybeans. Agents served on the SC Wild Hog Task Force and administered the QDMA Quality Deer Management Association online Deer Steward I program.

Results
The benefits of these best management practices included reduced erosion, bank stabilization, protection of water quality, added aesthetic value, nuisance waterfowl deterrence, and the attraction of desirable wildlife. Of those participating in wildlife programs, over 97% reported a gain in knowledge and over 70% of those gaining knowledge reported using practices learned.

4. Associated Knowledge Areas

KA Code	Knowledge Area
131	Alternative Uses of Land
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife

Outcome #3

1. Outcome Measures

Number of acres affected by sustainable forestry practices.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	500000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Forestry and forest products manufacturing are one of the largest economic drivers of South Carolina's economy, adding $17 billion annually to the State's economy.

What has been done

Extension agents developed and delivered 27 educational programs in the areas of Sustainable Forest Management and Natural Resources, reaching 886 people. Agents and specialists conducted fire assessments, and presented workshops on prescribed fire burning, timber taxation, pond management, hunting and land liability, forest landowner association meetings, and worked with individual families. Volunteers such as Master Naturalists were trained and they contributed over 22,163 hours of service. This statewide corps of volunteers provide education, outreach and service dedicated to the beneficial management of natural resources in South Carolina.

Results

Over 99% of those participating in programs gained knowledge. Total acres affected were about 500,000. Volunteer service hours represented $468,526 of program support.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
124	Urban Forestry

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

After a drought-ridden summer, areas in South Carolina were already considered a disaster in terms of the production of certain crops. Many growers estimated at least a 40% yield loss on all crops from the drought alone. Then came the historic floods that occurred in South Carolina in October of 2015. Flooding and continued rainfall that followed the flood event left many producers both unable to harvest crops in the field and plant winter crops.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Extension carries out ongoing program evaluation initiatives. Over 99% of those participating in programs gained knowledge. Total acres affected were about 500,000. Volunteer service hours represented $468,526 of program support.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Food Safety

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
502	New and Improved Food Products	5%	0%	17%	0%
503	Quality Maintenance in Storing and Marketing Food Products	5%	20%	17%	5%
703	Nutrition Education and Behavior	5%	30%	0%	35%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	40%	20%	33%	20%
723	Hazards to Human Health and Safety	30%	10%	33%	20%
724	Healthy Lifestyle	15%	20%	0%	20%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	5.0	3.5	1.9	1.0
Actual Paid	3.0	3.5	1.5	2.0
Actual Volunteer	2.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
243398	239800	200310	275759
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
243398	196636	139163	225713
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	126796	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Two hundred forty-two bacterial isolates were collected from chicken ceca and antimicrobial susceptibility testing was performed on all of the isolates and serotyping of all of the salmonella isolates. The number of isolates is what had been expected for 1 year and over the course of several years will provide a substantial collection of isolates and data for analysis. Multidrug resistant isolates are being identified. 73% of the salmonella isolates are Typhimurium and only 13% are Kentucky which contrasts with USDA FSIS findings of 30% Kentucky and 23% Typhimurium in their poultry cecal salmonella isolates.

Work to determine the effect of chlorine dioxide treatment on sensory, textural and total plate counts to measure the changes in sensory quality that occur in tomatoes as the result of chlorine dioxide treatment. Tomatoes were treated with two different levels of chlorine dioxide gas (10mg and 50mg per kg of tomato). These tomatoes were compared to untreated control tomatoes. The tests used to evaluate differences included flat-plate compression for firmness, sensory evaluation using a difference from control test, color analysis of the skin and flesh using a colorimeter, and enumeration of aerobic microbes and yeasts and molds.

Flat-plate compression of whole tomatoes revealed no significant difference in firmness between treated and untreated. Overall, no negative effects were initially measured in the tomatoes as a result of the chlorine dioxide treatments. However, significant differences in rates of senescence between the treated tomatoes and the control tomatoes were not observed, giving no measurable indication that tomato shelf-life was extended as a result of the treatments.

Safe handling of food was taught by Extension to handlers in the food service industry and the general public. Commercial food processors were targeted in an effort to improve commercial food processing efficiencies and effectiveness to develop new markets and improve commercial handling, processing, preservation and packaging to provide safe and high quality foods. Agents and specialists covered topics such as common food-borne pathogens, additives, preservatives and basic kitchen safety techniques. Participants increased knowledge and skills in safe handling of food. Managers and supervisors were certified to train food handlers in safe food handling techniques. Food handlers practiced safe food handling techniques. Specialists assisted in the development of new food businesses.

Research was conducted on ozone treatment as an alternative for conventional fumigation to manage insects in stored products. Various exposure times at a given lethal concentration to achieve 100% mortality for life stages of external and internal feeders of stored insects in products were evaluated. Eggs, larvae and adults of three external feeders and the same life stages of one internal feeder have been tested thus far.

Additional research was conducted on the US-European Union (EU) transatlantic trade and investment partnership: its potential impacts on food safety and SC agricultural production, exports and

trade. Surveys were collected from 190 farmers assessing their knowledge of aflatoxins. Testing for aflatoxins associated with peanuts and corn on SC farms was conducted. Protocols utilizing ozone as a possible treatment for peanuts and corn containing aflatoxins were developed.

2. Brief description of the target audience

The target audience includes community leaders, agencies, policy makers, general public, limited resource families, food service managers, supervisors, food handlers, producers, commercial food handlers, and the processing and packaging industry The target audience also includes entrepreneurs seeking to start food businesses or improve existing food business, media and other marketing contacts, and publication outlets - doctors' offices and grocers.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1682	625	976	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	1	6	7

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Licenses

Year	Actual
2016	0

Output #2

Output Measure

- Disclosures

Year	Actual
2016	0

Output #3

Output Measure

- Number of people completing educational workshops.

Year	Actual
2016	2914

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of participants reporting increased knowledge in safe food handling and applying practices learned.
2	Number of managers/supervisors/food handlers completing educational program and receiving a course certificate
3	Number of new or improved food products entering the market as a result of adopting recommended practices
4	Number of people reached through media outlets that utilize Extension food safety resources.

Outcome #1

1. Outcome Measures

Number of participants reporting increased knowledge in safe food handling and applying practices learned.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2176

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Food Safety program promotes healthy lifestyles and improves the quality and safety of food for the citizens of South Carolina.

What has been done
Agents and specialists conducted 127 programs in the area of food safety and food preservation education. The Food Safety for Reel video series was created to provide food safety education that is science-based and engaging. The videos are intended for use by consumers (viewing on-line), or use by instructors in the classroom who wish to provide a supplement to their curriculum with use of the video. The team began this series with their first video titled, Why Did the Chicken Cross Contaminate: A Tale of Cross Contamination. The video can be viewed at: https://www.youtube.com/watch?v=QgErL3DvIy8. In August 2015, the team developed their second video in the series titled, Time, Temperature, and Tailgating. This video can be viewed at: https://www.youtube.com/watch?v=AZilwDb4ykA&feature=youtu.be. The video discusses the topics of keeping hot food hot and cold food cold particularly in tailgating/party situations when food has the potential to be left in the temperature danger zone for long periods of times. In addition, canning coach volunteers delivered Canning 101 workshops, covering topics of preserving jam, jellies, tomatoes, and more.

Results
Of the adults participating in the educational programs, 98% reported a gain in knowledge. Videos are a useful medium for educating younger audiences on safe food handling practices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
703	Nutrition Education and Behavior
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety
724	Healthy Lifestyle

Outcome #2

1. Outcome Measures

Number of managers/supervisors/food handlers completing educational program and receiving a course certificate

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	310

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Center for Disease Control and Prevention (CDC) reports that there are five situations which cause most of the outbreaks of foodborne illness - poor personal hygiene, improper food holding temperatures, purchasing food from unsafe sources, failing to cook food adequately, and using contaminated equipment (cross-contamination). The CDC estimates that one in six individuals will become sick from the consumption of contaminated food each year, and 128,000 people will become so sick that they have to be hospitalized. Three thousand individuals each year die from foodborne illness in the U.S. The National Restaurant Association has estimated that the average cost of a food-borne illness outbreak to an establishment is about $75,000 and that does not include extrapolations for the long-term impact of losing someone.

What has been done

In an effort to reduce food-borne illness, agents conducted ServSafe® food safety training for managers, supervisors, and other food handlers. A total of 310 food-service employees representing 176 food establishments participated and received certification.

Results

The approximate economic value of the trainings has been conservatively estimated to be $13,200,000 by preventing foodborne illness outbreaks.

4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
703	Nutrition Education and Behavior
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #3

1. Outcome Measures

Number of new or improved food products entering the market as a result of adopting recommended practices

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	66

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Food entrepreneurs need knowledge on safety and wholesomeness of their products before they may sell them to the public. Their product must be in compliance with all local, state, and federal regulations. Moreover, food industry personnel who manufacture, process, package or distribute food are required by the FDA and SC Department of Agriculture to be certified in either HACCP (Juice, Seafood, Poultry or Meat) or HARPC (all other human food not covered by HACCP and apart of the Food Safety Modernization Act). The Food Safety program provides numerous educational programs that transfer knowledge to farmers, food manufacturers, entrepreneurs and consumers that improves the safety and quality of food for the citizens of South Carolina.

What has been done

Food2Market is one programs offered by Clemson University Cooperative Extension Service that assists food entrepreneurs in meeting the state and federal regulations and safety requirements necessary to produce and sell foods. Food2Market personnel work closely with the South Carolina Department of Agriculture, South Carolina Department of Health and Environmental

Control and Clemson's Livestock Poultry Health Department to deliver regulatory information and requirements for foods produced and sold in state. The team works one-on-one with entrepreneurs leading them through the steps needed to produce their food(s) for sale. This year, the Food2Market program has conducted food product testing and/or nutrient analysis for 66 individual entrepreneurs and has had contact with over 400 entrepreneurs assisting them via email, phone, workshops, one-on-one visits, and speaking engagements.

Results

A survey was conducted in 2015 of food entrepreneurs who have used the Food2Market program. Survey responses were received from individuals as far back as the inception of the program (April 2013) to evaluate effectiveness and to determine the success of their business. Of the 100 people that responded to the survey, 30% had products tested through the program, 10% attended a workshop, 38% had made contact using the phone, 50% had made contact via email and 25% had utilized the website for assistance/information. The survey also revealed that 53% of the respondents had products currently on the market for sale, 42% remain in the development stage, with the intention to begin selling soon and 5% had decided that they no longer wished to produce their product(s) for sale. Approximately 65% of respondents stated that they would prefer on-line training and about 45% of respondents are interested in attending workshops.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #4

1. Outcome Measures

Number of people reached through media outlets that utilize Extension food safety resources.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Stakeholders report that they are able to take advantage of the educational programs and the corresponding research results. Twenty-five participants have become certified from the food industry to be FDA-recognized Preventative Control Qualified Individuals (PCQIs). Three Extension Food Safety Team members have been trained to become lead instructors for FSMA's Preventative Controls for Human Foods (HARPC) law.

A survey revealed that 53% of the respondents (those who had used Clemson's Food2Market Program) had products currently on the market for sale and 42% remain in the development stage, with the intention to begin selling soon.

Research was conducted on ozone treatment as an alternative for conventional fumigation to manage insects in stored products. Various exposure times at a given lethal concentration to achieve 100% mortality for life stages of external and internal feeders of stored insects in products were evaluated. Eggs, larvae and adults of three external feeders and the same life stages of one internal feeder have been tested thus far.

Additional research was conducted on the US-European Union (EU) transatlantic trade and investment partnership: its potential impacts on food safety and SC agricultural production, exports and trade. Surveys were collected from 190 farmers assessing their knowledge of aflatoxins. Out of 190 farmers, 58% reported they never heard of aflatoxins, 26% revealed they somewhat knew about it, while only 16% definitely knew about it. Testing for aflatoxins associated with peanuts and corn on SC farms was conducted. Protocols utilizing ozone as a possible treatment for peanuts and corn containing aflatoxins was developed.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Community, Leadership, and Economic Development

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
601	Economics of Agricultural Production and Farm Management	5%	0%	0%	0%
602	Business Management, Finance, and Taxation	25%	0%	0%	0%
603	Market Economics	15%	0%	0%	0%
608	Community Resource Planning and Development	45%	25%	0%	20%
609	Economic Theory and Methods	0%	10%	50%	10%
610	Domestic Policy Analysis	10%	15%	0%	20%
801	Individual and Family Resource Management	0%	15%	0%	10%
802	Human Development and Family Well-Being	0%	15%	0%	15%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	0%	20%	50%	20%
806	Youth Development	0%	0%	0%	5%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	10.0	7.0	2.6	3.0
Actual Paid	10.0	7.0	3.5	6.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
489084	376223	185000	887267
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
489084	308459	90551	726241
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	78952	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The Community Leadership, Economic Development and Agribusiness Program sought to foster the development of local and regional food systems, promote entrepreneurial and agribusiness development, and enhance community resiliency and economic capacity. As a result of the devastating floods, the Extension Agribusiness Team partnered with other Extension teams to offer Financing the Farm meetings. Approximately 300 Disaster Assessment forms were collected at the State Farmer Flood Forum. Other risk management and marketing programs were conducted.

Agents provided information on market structure, rules, general vendor numbers, and market procedures for county farmer's market vendor management board. Extension Agents introduced local small farmers in Marlboro and Dillon Counties on the concept of profitability using the cut-up and sliced fresh locally grown vegetables alternative method. The GAP certified small producer in Dillon County is selling cut-up and sliced collard greens to the Florence County and Marlboro County School Systems. Other small farmers are selling cut-up/sliced vegetables at the Marlboro County Farmers Market, Roadside Stands, Restaurants, and other local market outlets. The cut-up and sliced vegetables will bring about double the profit comparing to not being cut-up and sliced.

Work continues to further knowledge of marine invertebrate settling mechanisms and apply these results to the innovation of Clemson's patent pending anti- fouling deterrent technologies, in which the organism's own endocrine molecules when covalently bound to a polymeric coating act to deter settlement.

Research also continues on cellular biomineralization, an important aspect of marine biofouling, The intracellular mineralization compartment from where molluscan cellular biomineralization ensues will be characterized. The knowledge gained will advance the science of marine cellular biomineralization and will enable future innovations in safe and effective and aquatic marine anti-fouling coatings and further scientific understanding from the growing threat of ocean acidification.

Research on US export credit programs enhancing export opportunities and increasing income for small agribusinesses and small farmers in SC continued. Questionnaires were administered. Participants were willing to participate in workshops to obtain more information.

A study looked at a new cross efficiency method in data envelopment analysis (DEA) for finding the most efficient decision making unit(s) were developed. The DEA to emergency relief supply chain was successfully applied. The emergency relief supply chain design problem was formulated.

An examination of dynamic linkages among capital investment, export, agribusiness, education, business climate and quality of life variables and economic development of SC was conducted. A needs assessment survey was developed.

Research on accelerating the usage of digital communication technologies by small agribusiness firms in SC was conducted. Data was collected on 1500 small agribusinesses. Semi-structured interviews were held. Internet presence was created for small agribusinesses as well as a website developed.

Transient instability is a major cause of power blackouts that have devastating effects on US farms in terms of significant losses of crops and livestock and substantial spoilage of refrigerated agricultural products. To conduct the research, mathematical formulations were developed as well as computer programs.

Farmers were contacted to complete surveys to determine the effects of noise induced hearing loss and high blood pressure among SC farmers and agricultural workers. Consent forms were signed. Educational materials were developed. A mobile van unit was created.

2. Brief description of the target audience

The target audience includes students, child care providers, limited-resource persons, community leaders, board/council members, nonprofit organization boards and groups, adults, youth, business and workforce preparation agencies and disadvantaged citizens and communities. In addition, state, federal, and local agency personnel, association members, citizens faced with public issues, and citizens engaged in economic and tourism development are included.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	7235	3749	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2016

Actual: 1

Patents listed

1. Conotoxin peptides for use in Bio-fouling Deterrence

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	4	4

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of publications and business plans.

Year	Actual
2016	3

Output #2

Output Measure

- Total number of people completing educational workshops.

Year	Actual
2016	5512

Output #3

Output Measure

- Number of business owners increased knowledge.

Year	Actual
2016	0

Output #4

Output Measure

- Patent Application

Year	Actual
2016	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Total number of people reporting increased knowledge in community improvement and development as a result of participation in CLED activities.
2	Number of participants engaged in community promotion projects
3	Number of successful collaborations to promote economic development

Outcome #1

1. Outcome Measures

Total number of people reporting increased knowledge in community improvement and development as a result of participation in CLED activities.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of participants engaged in community promotion projects

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2109

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Since 1988, the Adopt-A-Highway (AAH) program in South Carolina, partnering with PalmettoPride, has been one of the most successful programs in combating litter along the highways and promoting beautification in the state. Adopt-A-Highway program is coordinated by Community Pride, Inc., an organization sponsored by the Clemson Extension Service. The success comes from relying on more than 2,500 local volunteer groups who genuinely care about the beauty of their state and want to take responsibility for enhancing that beauty. Litter has been reduced by 62% over the past ten years. Unfortunately, there are still people who insist on littering. Our state and local governments do not have the resources available to clean up the litter on our roadways. Volunteers are invaluable to keeping our state clean. Clean communities are safer communities. Clean communities are good for the $15 billion dollar tourism industry and economic development in the state. Clean communities are a source of pride for all who call South Carolina home.

What has been done
The Adopt-A-Highway program provides an outlet for individuals, organizations, and businesses to help maintain sections of roadsides within the states highway system. Groups agree to adopt at least two miles of highway and participate in four litter cleanups per year for a minimum of two

years. On prescheduled Saturdays throughout the year, groups meet at sites throughout the county to pick up litter. South Carolina Department of Transportation provides supplies and safety vests. Collected litter is left on the site for pick up by SCDOT personnel. In 2015, four major cleanups were conducted. Approximately, 206 groups participated in the program accounting for 2,898 individual volunteers.

Results
Approximately 182 groups participated in the program accounting for 2,109 individual volunteers. An estimated 64,442 pounds or 32 tons of litter was removed from 412 miles of state maintained roadsides. Volunteers donated 10,970 hours of time to make their communities more aesthetically pleasing. Based on the estimated dollar value of volunteer time at $20.56 per hour, this provided a savings of $225,543 to our state and local government.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #3

1. Outcome Measures

Number of successful collaborations to promote economic development

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	10

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There is a need to grow healthy food businesses in areas throughout South Carolina. Communities with food deserts are often short on whole food providers, especially fresh fruits and vegetables and heavy on local quickie marts that provide a wealth of processed, sugar, and fat laden foods that are known contributors to the obesity epidemic in the US. Farmers markets have long been a great way to connect with the producers of local products; however, with their limited hours of operation coupled with a farmer's availability to participate, markets often are not able to

fully meet the demand for local food.

What has been done

Feeding Innovation is a comprehensive technical assistance program designed to support entrepreneurs interested in developing or expanding healthy food businesses in food deserts or underserved areas of the state. Participants engaged in five 8-week entrepreneurial training program with NxLevel Courses, offered through Clemson Extension. The program culminates with entrepreneurs pitching a business plan to a panel of judges. The entrepreneur with the strongest business plan receives $12,500 in seed capital for their business. Through the Catawba Fresh Market, orders can be placed online, and processed through local growers. Food is delivered to pre-determined customer pick-up sites. The site (www.catawbafreshmarket.com) has 42 active farmers selling items such as meat, eggs, produce, breads and other value-added products.

Results

Five classes have graduated over 45 small businesses. Of these graduates, five have been awarded start-up funds. Successful collaborations have included SC State University, USC Upstate, the SC SBDC, USC Medical School, Greenville Library, the City of Florence, and the South Carolina Community Loan Fund. Catawba Market sales increased with $1917.06 worth of transactions averaging $18.00 an order during the year. Clemson Extension and the Catawba Farm and Food Coalition launched the Catawba Region Food Systems Agency Roundtable to encourage collaboration, networking and professional development of members of food and farming related organizations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
603	Market Economics
608	Community Resource Planning and Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

After a drought-ridden summer, areas in South Carolina were already considered a disaster in terms of the production of certain crops. Many growers estimated at least a 40% yield loss on all crops from the drought alone. Then came the historic floods that occurred in South Carolina in October of 2015. Flooding and continued rainfall that followed the flood event left many producers both unable to harvest crops in the field and plant winter crops.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Both Extension and research utilize evaluation results to modify and improve programs. The impact of the Catawba Fresh Market is expanding as the number of active customers has grown 169% from 2014 to 2015. Sales increased as well with $1917.06 worth of transactions averaging $18.00 an order during the year. Having this new and innovative marketing platform will give participating farmers a new revenue stream and risk management strategy while giving local consumers a new and innovative way to purchase locally.

The average farm income for a SC small farmer in 2016 was $17,483 per annum. 2.7% of farmers said they exported their products. Of the farmers who did not export, only 41.6% wanted to learn about the export market. 94% did not know about General Sales Manager (GSM) 102. However, 78.9% were not familiar with Commodity Credit Corporation (CCC). 65.8% said they would be willing to participate in a workshop to learn more about the US export credit programs.

The emergency relief supply chain design problem was formulated as the multi-object programming (MOP) model. The new and innovative proposed procedure enabled the researcher to win the Best Paper Award in Application of Theory for the 2016 Northeast Decision Sciences Institute Conference in Alexandria, VA.

Data collected on 1500 small agribusinesses suggested 31.3% of small agribusinesses had a website to market their products. Only 28% of the websites had e-commerce capabilities. 21 semi-structured interviews were conducted with a variety of agribusiness operators to understand the challenges related to adoption of digital platform for marketing. All interviewees cited the lack of technological skills and unavailability of affordable external assistance as the two major barriers. The research team established an Ag-Business Digital Media Integration (DMI) Lab. A project website was created to increase awareness about the DMI Lab. Three small businesses were assisted in improving digital engagement through website creation, search engine optimization (SEO) and social media integration.

Specifications for a customized mobile van unit were created to test the effects of noise induced hearing loss and high blood pressure of farmers and agricultural workers. The van was delivered to a specialty vehicle company to be up-fitted. Once the van has been returned, pertinent data will be collected and disseminated to communities of interest.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

4-H Youth Development and Families

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
801	Individual and Family Resource Management	5%	10%	0%	20%
802	Human Development and Family Well-Being	15%	20%	0%	25%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	30%	20%	0%	25%
806	Youth Development	50%	50%	0%	30%
	Total	100%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	22.0	11.5	0.0	1.0
Actual Paid	25.0	11.5	0.0	3.0
Actual Volunteer	10.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
858827	444851	0	280129
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
858827	364733	0	229290
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Clemson Agents and volunteers reached youth and family members through educational programs on agriculture, science and technology, natural resources, food safety and nutrition, and leadership skills. In STEM programs, youth used critical thinking and problem-solving skills. Youth in Clemson Extension 4-H programs are involved in hands on nature based programs such as Jr. Master Gardener, 4-H20, Dairy Heifer, Livestock, Barrow, Swine, Sheep, Beef, Poultry/Embryology, Gardening, Goat, Horse, Rabbit and other plant and animal projects. Youth participated in hunting safety programs, natural resource clubs, shotgun and rifle clubs, 4-H archery clubs, forestry camps, 4H20 camps, recycling clubs, and Food and Cover Establishment for wildlife programs. Agents reached youth and adults during in school and after school programs, day camps, summer camps, community centers, Head Start, churches, and libraries. In addition, agents used various media, including social media outlets to publicize nutrition information

In regard to research, comprehensive systems of curriculum, assessment and program evaluation guided by sound early childhood practices, effective early learning standards and program standards and a set of core principles and values will be constructed. The implementation of a planned, challenging, engaging and comprehensive curriculum will promote outcomes for all young children. An assessment of young children's strengths, progress and needs will be conducted. The research will help programs improve their educational and developmental interventions.

SC State Extension continues to address quality of life opportunities for the citizens of SC with a special emphasis on limited-resource communities. Outreach programs and services were provided to constituents in the areas of agriculture/natural resources, family life, health and nutrition, youth development, community economic development education and technology. Extension delivered programs on citizenship, financial management, leadership skills, basic life skills and character education. Youth also participated in several camps and after-school programs throughout the state.

Research was conducted on challenging and encouraging African American males to be successful in mathematics. Students participated in the "We Can Too Program". Research assistants mentored and tutored students in mathematics after school. Workshops were held with the project parents and students. Researcher focused on ACT and SAT preparation. A two week non-residential summer mathematics enrichment program was held. Pre and Post test were administered.

In other research dealing with appropriate assessment, curriculum and best strategies utilized by community-based child care center-based programs, observations of 15 children were conducted over the course of a semester. Assessments were made to assess child strengths and weaknesses in order to best train early childhood teachers to utilize best practices.

A new research initiative dealt with financially literate entrepreneurship for rural youth and families, involves a pilot study at two SC low country high schools. Project participants were recruited. Pre and post test surveys were created and disseminated. Workshops and presentations were prepared.

2. Brief description of the target audience

The 4-H program will target the following audience:

All youth between the ages of five and eight
All youth between the ages of nine and nineteen
Parents and other adults interested in the development of South Carolina youth.
Parents and young adults ages 30-44
Mature volunteers ages 45-64
Grandparent and Senior Volunteers ages 65+
Adult learners (college students)
Teachers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	3352	23050	70341	8894

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2016

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	1	1

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of people participating in educational workshops conducted

Year	Actual
2016	71966

Output #2

Output Measure

- Total number of adult volunteers (including non-Extension staff) trained in club, school enrichment, and special interest program delivery and management in all 4-H project areas.

Year	Actual

2016 3352

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of trained adult volunteers and staff, (including non-Extension staff) who teach subject matter and life skills to youth
2	Number of youth who gain knowledge in leadership and citizenship project areas
3	Number of youth participating in service learning projects for the community and to improve themselves, and help others.
4	Number of youth who gain knowledge and skills about plants, livestock and/or pets.
5	Number of youth who develop knowledge and skills in science, engineering, and technology (including electricity, computers, pontoon classroom, etc.).
6	Number of youth who gain knowledge in natural resources and shooting sports.
7	Number of youth who develop and improve communication skills through speaking and debating.
8	Number of youth increased knowledge in financial management.

Outcome #1

1. Outcome Measures

Number of trained adult volunteers and staff, (including non-Extension staff) who teach subject matter and life skills to youth

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	3352

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There is a need for an effective system to develop volunteer trainers in 4-H Youth Development.

What has been done
Clemson Extension trained over 3,352 adult volunteers, who then trained youth in leadership development; hunting safety; plant and animal projects; science, technology and engineering projects; day and overnight camping; and nutrition, health and fitness. Agents and volunteers used Facebook, web pages, Skype, exhibits, and traditional media to promote youth development programs. Volunteers also participated in the state Volunteer Leaders Symposium. They receive a monthly newsletter with helpful information from the state 4-H office.

Results
Volunteers were equipped for leadership roles and have made positive impacts and contributions in their communities and trained youth with new knowledge and skills. 4-H adults and teens contributed 20,112 hours of volunteer service, which represents a $425,167 value of program support. Volunteers reported seeing significant improvement in the children's overall problem-solving skills as well as the children's willingness to work together as a team to solve problems and make decisions. In addition, there were reports that youth used creativity and displayed increased self- confidence and self-pride as they accomplished projects.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #2

1. Outcome Measures

Number of youth who gain knowledge in leadership and citizenship project areas

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	14903

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Youth have basic needs that include developing a sense that they are valuable contributing members of their family and community. 4-H helps them serve more effectively in their leadership roles at the club, county, regional, or state levels.

What has been done
Over 14,903 Clemson and SC State 4-H youth participated in leadership training which included record keeping and portfolio development for financial management, ambassador training, 4-H State Congress, county teen councils, teen weekends, Manners Matter, Jr., 4H School Enrichment, After School and Local Clubs, SC 4H Horse Ambassadors Training, Parliamentary Procedures, 7 Habits of Highly Effective Teens and the Southern Region Teen Leadership Conference. They participated in Ambassador training, which teaches them how to effectively represent 4-H to the public and are involved in writing and speaking to the media. In addition, 25 youth are nature ambassadors working special events to promote nature, recycling, and conservation. One youth attended the National Shooting Sports Leadership Institute; after the conference, she was chosen to be a National 4-H Shooting Sports Ambassador. Youth participated in the State Healthy Lifestyles Summit, which trained them to go back to counties and implement summer camps. 4-H developed the Pinckney Leadership Conference in honor of Senator Clementa Pinckney, who was killed in the tragic Mother Emanuel Church shooting. The Pinckney conference was to develop leadership skills in youth, instill in them the importance of giving back to their community throughout life, to develop an atmosphere and understanding of the importance of community, and to develop the life skills to become contributing adults in society. Twenty-five youth participated in the 7-day conference.

Results

Approximately 250 youth and adults participated the State Legislative Day. Another senior 4-Her served as an intern at the National 4-H Conference Center in Chevy Chase, Maryland. Four youth represented South Carolina at the 2016 National 4-H Conference in Washington, DC. The students engaged in developing and presenting ideas about important issues that affect the entire country. Gains have been reported in knowledge of civic engagement, improvement in self-esteem, new skills demonstrated, and improved connections to the community. Seven students represented SC State Extension at the Citizenship Washington Focus. They learned leadership skills to make changes in their communities. The students are presently working on the learned skills and implementing some of the lessons learned.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
806	Youth Development

Outcome #3

1. Outcome Measures

Number of youth participating in service learning projects for the community and to improve themselves, and help others.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1813

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Findings from the 4-H Study of Positive Youth Development indicate that young people in 4-H are three times more likely to contribute to their communities than youth not participating in 4-H.

What has been done
Youth were involved in Community and Volunteer Service and in Civic Engagement. Youth planned and participated in service projects, such as the Pie Service Project, Canes and Crafts, and collected perishable items from citizens to donate to the Red Cross. They have distributed

323 HERO packs for Army National Guard youth with deployed family members to date. They made over 249 kits for shoes for the Sole Hope project to send to Uganda to prevent kids from the effects of jiggers. They are returning to their communities to have sole hope cutting parties. Youth prepared 24 bags that were designed to give to youth as they come into the foster care system. 4-H sponsored a 5-k run and raised $280 for Special Olympics. One of the 4-Hers conducts a fashion show every year to raise funds for disadvantaged youth. She raised $18,000 this year. Youth also participated in National Congress service projects.

Results

Youth volunteers gave approximately 8760 service hours. The service hours that were contributed were valued at more than $180,105 (hrs. x $20.56). Studies show that youth develop in areas of civic engagement, respect, and social responsibility through participating in service-learning projects. Service learning can also have a positive effect on students' ability to relate to culturally diverse groups (Fox, 2010). These traits have been observed in youth participating in service projects. Youth learned about their communities and were contributing members in them.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
806	Youth Development

Outcome #4

1. Outcome Measures

Number of youth who gain knowledge and skills about plants, livestock and/or pets.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	15240

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Research reveals that when children have hands-on experiences with nature, the results can lead to fewer incidents of anxiety and depression, improved self-esteem, enhanced brain development, and a sense of connectedness to the community and the environment. They have

opportunities for such development by participating in the 4-H Plants and Animals project.

What has been done

Youth were involved in animal projects such as, pullet, embryology, livestock, swine, horse, rabbit, lamb, and goat. Youth participated in the Horse Bowl, Junior Beef Round Up, Southern Regional 4H Horse Championships, SC National Livestock Judging Team Contest. 4-Hers learned environmental conservation through participation in activities such as establishing community gardens, the SC 4-H Small Garden Project, and Jr. Master Gardener Program. County 4-H units continued to partner with school districts to establish and maintain butterfly and vegetable gardens.

Results

The youth were able to experience gardening, from soil and seed and from the market to the table. 4-H Community Gardening efforts alone have impacted more than thousands of youth and families through active participation and community outreach. Youth learned about composting, rainwater harvesting, and watershed pollutants. By raising show animals and competing in livestock shows, the youth learned valuable animal husbandry lessons in nutrition, genetics, reproduction, animal health, and handling techniques. Youth also were able to increase their ability to select good livestock and learned the responsibility needed to raise and manage these animals. Showing livestock also helps build confidence in the youth and teaches them responsibility.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
806	Youth Development

Outcome #5

1. Outcome Measures

Number of youth who develop knowledge and skills in science, engineering, and technology (including electricity, computers, pontoon classroom, etc.).

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	27060

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Science and technology skills are needed if youth are to keep up with the rapidly changing knowledge-based and knowledge-transfer society. Most careers that began in 2012 required some knowledge of geospatial technology and systems. The 4-H program in South Carolina offers youth the opportunity to develop knowledge and skills in science, engineering, and technology.

What has been done

4-H partnered with University of SC Salkehatchie to provide computer coding and robotics training for teachers. Youth participated in a variety of Science, Robotics and Woodworking projects, such as ATV Safety, creating a crane, designing, creating, testing and improving a physical structure and a prototype helmet. The 4Hers learned about the anatomy of the brain and brain injuries, which gave them a greater understanding of the importance of proper safety equipment. 4Hers also participated in a STEM day camp and Science on the Move. Participants left with a greater interest in science and improved technology (Ipad and GPS) skills. At the Naval Weapons Station and Northwoods Community Park Center the 4Hers worked with the app-controlled robotic spheres known as Spheros. The group increased their technology skills as they began learning how to program (code) the Orbotix Spheros using the iPads. Other activities included Motion Commotion, Delving into DNA, Balloon Cars, Paper Rockets, Snap Circuits, and Garden in a Glove, 4-H Crazy Chemistry Camp, 4H Emc2, 4H Robotics Camp, 4-H Engineering Camp, 4-H Engineering Challenge, 4H CSI Forensics Fun Day.

Results

Over 27,000 youth participated in the 4-H Science and Technology programs. 4-Hers constructed simple robots and began programming robots using classroom laptops. These projects improved their technology skills as well as taught them teamwork and communication skills as they work together in groups. Youth learned through the study of forensics in the Science on the Move program, techniques to extract DNA. Through the robotics program they demonstrated the use of math, critical thinking, problem solving, and creativity, which are valuable life skills.

4. Associated Knowledge Areas

KA Code	Knowledge Area
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
806	Youth Development

Outcome #6

1. Outcome Measures

Number of youth who gain knowledge in natural resources and shooting sports.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2445

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Many youth either participate in hunting or have family members who hunt and, therefore, have access to guns. Some youth do not have any formal training in the safe use and handling of firearms. Although rare, accidents with firearms do occur, and often are the result of improper handling of firearms. Exposing youth to firearms and teaching both adults and youth the proper way to safely handle firearms can reduce the risk of accidents. In addition, this program promoted natural resource conservation.

What has been done
Youth participated in hunting safety programs, natural resource clubs, 4-H archery clubs, forestry and 4H20 camps, recycling clubs, and wildlife programs. Some 350 youth participated in shooting sports program, including shotgun and rifle clubs. A youth participated in the National Shooting Sports Leadership Institute. Youth learned components of wildlife habitat, water quality, and environmental stewardship.

Results
4-H established partnerships with high schools and colleges to deliver programming. Youth demonstrated wise decision-making skills and self-confidence. They demonstrated caring of their environment and established food plots to benefit small game and other wildlife species. They demonstrated proper shotgun handling.

4. Associated Knowledge Areas

KA Code	Knowledge Area
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
806	Youth Development

Outcome #7

1. Outcome Measures

Number of youth who develop and improve communication skills through speaking and debating.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	447

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Youth need opportunities to develop assets such as good communication skills, organizational abilities, reasoning skills, and self-confidence. They have opportunities for such development through participating in the Communication and Expressive Arts projects.

What has been done
Twenty programs were conducted reaching 447 youth. Youth gave presentations and demonstrations during club and county level contests and gave speeches at community organizations promoting 4-H.

Results
Youth successfully prepared and gave presentations. They demonstrated good communication skills, organizational abilities, reasoning skills, and self-confidence. Youth researched various topics and presented information.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
806	Youth Development

Outcome #8

1. Outcome Measures

Number of youth increased knowledge in financial management.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	447

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Families, youth and children are interested in comprehensive money management skills and financial development to avoid financial destruction. Individuals, especially youth, need to learn skills which will help them improve their situation financially as they transition into adulthood. Basic money management skills will help to make good financial choices and understand the importance of saving money.

What has been done
Basic money management skills such as mathematical calculations and decision making were discussed in educational workshops. Budgets were created and discussions on savings and investments to earn profit were held. Pre and post test were administered.

Results
As a result of the program, 65% of youth surveyed stated they learned basic money management skills. Money Smart instilled experiential learning and money management skills. Of the number surveyed, 15% were interested in starting a checking or savings account in the future. Ninety-eight percent of the students graduated from the Money Smart course.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Observation and pre-post tests were conducted. 4-H youth used math skills, critical thinking and creativity to address issues and solve problems which are valuable life skills. They contributed to their communities, learned how to work in teams, and demonstrated leadership. 4-H adults and teens contributed 20,112 hours of volunteer service, which represents a $425,167 value of program support.

In research, developmentally appropriate instructional practices were inconsistently used because the majority (over 50%) of the learning experiences were (1) teacher-centered, (2) large groups and (3) focused on worksheet exercises or uniformed learning assignments. 62% of the time teachers were talking, while only 35% of the time children were talking with the remaining 3% undetermined. Large group time predominated the regular school day relative to the number of small group learning experiences. Pre-fabricated worksheets and uniformed assignment (i.e., making a "B" Book) were the focus of 72% of small group times. A major problem was the lack of a systematic way to evaluate the appropriateness or effectiveness of the curriculum with some curriculum being in use for years without any notion of reviewing it for relevance of obsoleteness.

The research on African American males being successful in mathematics participated in a 2 week non-residential summer enrichment program where a pre and post test was administered. Real-world applications and problem solving was essential to each lesson. An iPad mini was administered for instructional purposes. Mathematical scores increased by 25% of the participants.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Nutrition and Childhood Obesity

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
701	Nutrient Composition of Food	0%	10%	0%	10%
702	Requirements and Function of Nutrients and Other Food Components	0%	10%	0%	10%
703	Nutrition Education and Behavior	50%	30%	0%	40%
723	Hazards to Human Health and Safety	5%	30%	0%	10%
724	Healthy Lifestyle	45%	20%	0%	30%
	Total	100%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	21.0	4.0	0.0	5.0
Actual Paid	23.0	5.0	0.0	4.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
531833	160034	0	465246
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
531833	131228	0	380811
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Associations will be explored between family domain factors, child physical activity and eating behaviors. Measures of family domain factors associated with child physical activity and eating behaviors will be developed and refined. This program will delineate the strength and direction of the relationships between family domain factors with the greatest potential for change through community based interventions. A pilot test will be conducted of an intervention targeted towards family factors that mediate child physical activity and eating behaviors.

Clemson University Cooperative Extension as well as South Carolina State 1890 Research and Extension focused on nutrition and wellness programs for youth directed towards the prevention of childhood obesity, increasing physical activity and the development of food preparation skills that fit current nutritional needs and lifestyles. Agents organized health fairs and taught boot camps and workshops for school cafeteria supervisors and state staff from across South Carolina. Agents taught youth and adult audiences Dietary Guidelines, Healthy Lifestyles, Cooking Healthy-Eating Smart, Fit Family Challenge, and Kids in the Kitchen. Agents reached youth and adults during in school and after school programs, healthy lifestyles day camps, summer camps, community centers, senior action centers, Head Start, churches, and libraries. Some of the topics taught by agents included basic nutrition, how to make healthy food choices, reading food labels, the importance of eating a balanced breakfast and food safety in preparation and storage. In addition, agents used various media, including social media outlets to publicize nutrition information.

Four research projects were included in the Nutrition and Childhood Obesity Planned Program. Two were continuations, while 2 were new initiatives. To help combat childhood obesity, a variety of activities, lessons and field experiences were presented to faculty, staff and students at the Child Development Learning Center on the campus of SC State University. Activities included planting gardens, learning about locally grown foods and how to prepare foods. Youth were introduced to a variety of fruits and vegetables. Field experiences centered on gardening, production, preparation and consumption. Knowledge was gained on how some foods were consumed from the beginning to reclaim a healthy heritage. Although food is a necessity in life, over indulging to the point of becoming obese is unhealthy. Obesity is among the top five preventable causes of many common cancers. Current research on the subject supports a strong link between obesity, type-2 diabetes, metabolic syndrome and cancer - related mortality. The factor that links diabetes, obesity and the metabolic syndrome with cancer is believed to be hyperinsulinemia, which triggers the increase of the peptide growth factor insulin-like growth factor (IGF)-1 in the blood. Therefore, research was conducted on the reduction of cancer risk caused by obesity and metabolic syndrome: inhibition of insulin-like growth factor (IGF)-1 receptor signaling. Experiments were performed and completed. One publication was published. Further experiments could be based on the knowledge gained to improve strategies used in targeting signaling pathways in cancer therapy.

2. Brief description of the target audience

The target audience includes agencies that serve all income levels, including limited resource families and youth and general youth and adult audiences.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	127	489	46093	2051

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2016

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	1	4	5

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of children and youth reached in healthy eating programs.

Year	Actual
2016	5922

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of people gaining knowledge as a result of participating in educational workshops.
2	Number of children and youth gaining knowledge in eating healthy foods.

Outcome #1

1. Outcome Measures

Number of people gaining knowledge as a result of participating in educational workshops.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	33576

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The prevalence of overweightness and obesity has become one of the most critical health issues in both South Carolina and the United States. Overweightness and obesity cut across all ages, economic levels, and racial and ethnic groups. In South Carolina, over sixty percent of all adults are now either overweight or obese. Children learn eating behaviors from adults and peers. In the US, nearly one out of three children and teens ages 2 to 19 is overweight or obese. The S.C. Obesity Burden Report found that 64 percent of middle school students and 76 percent of high school students did not attend physical education classes each week and less than 25 percent consumed the recommended daily servings for fruit and vegetables.

What has been done
Nutrition Agents taught or implemented some 645 programs including cooking camps, 4H Healthy Lifestyles Programs and clubs, Kids in the Kitchen, Cook-offs and contests, and other nutrition programs. Youth Voice, Youth Choice, a grant received from Walmart, allowed agents to prepare kits to teach children nutrition lessons. SC 4H Healthy Lifestyles Lessons are used with in the classroom, homeschool, and with after school programs. Senior, Junior and Cloverleaf Teams were trained for the 2015 State 4H Healthy Lifestyles Competition. Topics included food safety, nutrient knowledge, and public speaking. SC Dept. of Agriculture's Chef Ambassador, helped teach the students proper cooking techniques and knife safety.

Results
Ninety-eight of the participants reported that they increased their nutrition knowledge about fruits, vegetables, snacks and serving sizes.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food
703	Nutrition Education and Behavior
723	Hazards to Human Health and Safety
724	Healthy Lifestyle

Outcome #2

1. Outcome Measures

Number of children and youth gaining knowledge in eating healthy foods.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	4946

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
South Carolina ranks as one of the heaviest states in America with 66.9% of adults over the age of 18 being overweight and 31% of adults being considered obese. Thirty-eight percent of children are considered obese. There is grave concern if adults are overweight, because the children will probably follow suit because the parents buy the food as well as prepare it.

What has been done
Reading food labels, counting calories and meal planning were discussed in workshops. Wellness classes were provided illustrating the importance of eating healthy and being active. Pre and post test were administered.

Results
The project resulted in 381 workshops, activities and/or demonstrations. The importance of consuming healthy food choices, being active for at least 60 minutes, team sports and cooking alternatives were taught. Sixty percent gained knowledge concerning eating healthy foods. Thirty-four percent stated they intended to adopt healthier eating patterns, while 28% planned to increase the amount of time being physically active. Adults and youth realized the importance of choosing healthier snacks more often by reading labels.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
723	Hazards to Human Health and Safety
724	Healthy Lifestyle

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

After a drought-ridden summer, areas in South Carolina were already considered a disaster in terms of the production of certain crops. Many growers estimated at least a 40% yield loss on all crops from the drought alone. Then came the historic floods that occurred in South Carolina in October of 2015. Flooding and continued rainfall that followed the flood event left many producers both unable to harvest crops in the field and plant winter crops. The availability of food resulting from a decreased crop harvest may have affected the choice of locally grown food, especially at neighborhood farmers markets.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

A monthly nutritional newsletter was developed and distributed to the students. Inside each child development classroom, the students utilized nutritional learning tools such as a gardening stand along with the associated foods, portion controlled dinnerware, grocery bags and lists and iPads to interact with nutritional games. Nutritional cards, shopping bags, MyPlate portion controlled cups, plates and silverware and cookbooks were given to students to take home for extended use and learning. A Food and Nutritional Lesson Plan Booklet to serve as a curricular supplement in the early childhood setting was developed. Ninety-eight percent of the participants increased their nutrition knowledge.

In other research, the results showed cancer cell lines used (two pancreatic carcinomas and one lung cancer) showed a spectrum of dependence on IGF-1 for tumorigenic activity, as evidenced by their sensitivity to the inhibitors used. Project results showed concurrent use of inhibitors on one signaling pathway had significant therapeutic value and the effect was different for different types of cancer.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Climate Change

☐ Reporting on this Program

Reason for not reporting

Research efforts in Climate Change were moved to the Natural Resources Program because there was complementary work underway in Natural Resources which will allow increased levels of collaboration and an expanded resource base. The move will also facilitate the Experiment Station's efforts to cluster related research at the project level.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	1.0	1.0
Actual Paid	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

2. Brief description of the target audience

The target audience will include regulatory agencies, resource managers, local county and municipal officials and public works staff.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2016

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	8	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Disclosures

Year	Actual
2016	0

Output #2

Output Measure

- Licenses

Year	Actual
2016	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Provide knowledge to policy makers to assist in coping with the effects of climate change, particularly in the coastal region.

Outcome #1

1. Outcome Measures

Provide knowledge to policy makers to assist in coping with the effects of climate change, particularly in the coastal region.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 9

1. Name of the Planned Program

Sustainable Energy

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
123	Management and Sustainability of Forest Resources	100%	0%	0%	10%
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	50%	30%
402	Engineering Systems and Equipment	0%	0%	50%	30%
403	Waste Disposal, Recycling, and Reuse	0%	0%	0%	25%
511	New and Improved Non-Food Products and Processes	0%	0%	0%	5%
	Total	100%	0%	100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	4.0	0.0	2.4	1.0
Actual Paid	4.0	0.0	0.5	1.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
149308	0	92613	292301
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
149308	0	88759	239253
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	3002770	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

In the area of biofuels, efforts continue to mimic the natural degradation process by allowing the bacteria and fungi to work together to convert switchgrass to soluble sugars. A bacterial/fungal community has been developed and evaluated for the conversion of switchgrass. It is anticipated that there is the potential to enhance previous results by evaluating changes in the growth conditions to enhance this conversion efficacy. Once a more optimal growth condition is developed, then the bacterial/fungal community will be allowed to grow in a bioreactor to produce the hydrolytic enzymes that convert switchgrass to evaluate the enhanced conversion efficacy.

Other progress in biomass research includes:

A biodiesel pilot plant - conversion of waste cooking oils generated on campus to biodiesel to displace diesel fuel in campus vehicles - about 30% has been displaced over the past 3 years.

The design of a 10 MW biomass facility has been proposed for the Clemson campus.

A Black Soldier Fly (BSF) digester is now in operation and used for research of food waste and organic farm waste management.

Aviation biofuels and biomass feedstock research is ongoing, using algal and fungal oils for conversion to aviation biofuels, using enzymatic catalysis and use of residues as adhesive additives to biomass pellets for gasification research.

Additional research, in the beginning stage, is being investigated on alternative sources of vegetable oil from non-edible plant seeds for biodiesel production. The goal is to search for an alternative vegetable oil source indigenous to South Carolina that is non-food or non-staple based with relatively high oil yield, easy to grow and with a short maturation period. Ten plant seeds were identified and procured. The oils from the seeds were extracted and some of their properties were determined including yields, densities and iodine values. More seeds will be tested and other properties investigated.

Extension conducted educational programs and demonstration projects to help the producer make informed decisions to improve profitability of energy crops.

2. Brief description of the target audience

All consumers in the state will benefit from research and education programs related to lower cost energy options.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	4620	789	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	3	3

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Disclosures

Year	Actual
2016	0

Output #2

Output Measure

- License agreements

Year	Actual
2016	0

Output #3

Output Measure

- Number of people completing educational workshops

Year	Actual
2016	3395

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of people reporting knowledge gained in sustainable energy and land management and diversification strategies.

Outcome #1

1. Outcome Measures

Number of people reporting knowledge gained in sustainable energy and land management and diversification strategies.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	3393

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
This program promoted the use of Best Management Practices for forest systems and other natural resources to improve South Carolina's forest productivity, environmental sustainability and sustainable energy. In addition, farm and forest landowners in South Carolina were seeking management and diversification strategies to generate additional income and profitability.

What has been done
Workshops were conducted on the topics of prescribed fire burning, timber harvesting, forest herbicides, Timber Taxation, the SC Tree Farm program, Estate Planning, Women Landowners, Climate Change Workshop, Top Logger Certification classes, Forest Ethics webinar, and Forest Roads, Wood Utilization and Wood Supplier System online program. Articles were published to promote the stewardship of South Carolina's urban and community forests. Resource information was made available through the quarterly Woodland Magazine, Tree Farmer Bulletin, newsletters, and webinars. A link to www.MyLandPlan.com was made available on the web to help landowners manage their property.

Results
Of the 3,395 people attending programs, 99% reported that they gained knowledge.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
511	New and Improved Non-Food Products and Processes

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

After a drought-ridden summer, areas in South Carolina were already considered a disaster in terms of the production of certain crops. Many growers estimated at least a 40% yield loss on all crops from the drought alone. Then came the historic floods that occurred in South Carolina in October of 2015. Flooding and continued rainfall that followed the flood event left many producers both unable to harvest crops in the field and plant winter crops.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Evaluation of research and Extension activities are ongoing. Of the 3,395 people attending programs, 99% reported that they gained knowledge.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 10

1. Name of the Planned Program

Global Food Security and Hunger

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	10%	10%	14%	0%
204	Plant Product Quality and Utility (Preharvest)	10%	25%	17%	0%
205	Plant Management Systems	15%	25%	24%	0%
211	Insects, Mites, and Other Arthropods Affecting Plants	0%	0%	7%	0%
212	Pathogens and Nematodes Affecting Plants	25%	0%	10%	0%
213	Weeds Affecting Plants	10%	0%	4%	0%
216	Integrated Pest Management Systems	20%	0%	7%	0%
601	Economics of Agricultural Production and Farm Management	5%	40%	17%	0%
701	Nutrient Composition of Food	5%	0%	0%	0%
	Total	100%	100%	100%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	30.0	8.0	5.0	1.0
Actual Paid	32.0	8.0	18.4	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
1307224	325040	2225588	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1307224	266489	2748112	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	6146915	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Standardized protocol for bacterial spot and brown rot phenotyping have been developed and used to phenotype material in the peach breeding program.

Recommendations from research on Megacopta cribraria (the kudzu bug) likely saved soybean producers in South Carolina and the region millions of dollars in control costs and crop losses. A Variable Rate Intelligent Center Pivot (VRICP) system was developed by integrating sensor-based irrigation scheduling with variable rate irrigation technology.

A rootstock 'Bulldog" that has resistance to Fusarium Wilt and tolerance to root knot Nematodes was developed.

The fungicides Aprovia Top, Luna Experience, and Inspire Super were equally effective in spray programs to manage gummy stem blight on fall watermelon. These fungicides can be used to manage gummy stem blight and prevent yield loss.

Intelligent Agri-tronic Devices (IAD) and methodology for site specific management of crop inputs (irrigation, nutrients, pesticides, etc.) or for cattle production to enhance farm profits and environmental sustainability were developed.

The presence of a thick layer of killed cover crop residue will suppress Palmer amaranth. Cover crop mixtures also enhance key soil attributes by adding nutrients to the soil, improving soil structure, and increasing organic matter content.

Hardware and software components were developed to automate irrigation scheduling of a VRI center pivot, based on soil moisture sensing,

Field trials of remote sensing showed that cotton boll injury from stink bugs was spatially correlated with crop growth measured by a multispectral vegetation index. This information has potential to reduce insecticide inputs by targeting at-risk areas of field as determined by remote sensing.

Two varieties have been released, one oat 'Graham' and one southern pea 'Ogle'. 4 elite wheat lines have been produced and one line is in process of being released. Seed numbers of 60 heirloom vegetable varieties have been increased and made available to the public. Official variety trials have been conducted on corn, wheat, oats, barley, soybean, sorghum, cotton, canola, and flax.

The historic flooding of October 2015 caused concerns among farmers about nutrient loss, organic matter decomposition, pH fluctuations, and soil movement in their fields. Compounding the situation is the major loss of income associated with the floods and how that impacts their ability to afford remedial fertilization. Representatives from crop insurance, USDAFSA, the legislature were present to talk about what was being done to assist the farmers. The Agronomic Team collaborated with the Agribusiness Team to offer Financing the Farm meetings in response to questions left from the devastating crop season of 2015. Farmers learned about managing risk, EBITDA, enterprise budgets and the market outlook for 2016. Other programs such as Nutrient Management After the Floods address the concerns and questions farmers had about how the floods had impacted their soils.

Agents collected information through interviews, pictures and videos to show the agricultural damage and issues were pushed into the spotlight. Elected officials and others took notice of the situation statewide and have in turn proposed a State Farm Bill, which created the Plant it Forward Program, and provided South Carolina a chance to compete for federal funding from the omnibus spending bill. The information from meetings conducted by the agents will hopefully help growers to stay up-to-date on legislative issues so that they can analyze their current situation. Extension partnered with Clemson Broadcasting to help tell the story of farmers affected from the flood. Personal stories of farmers affected and the damage in the field were videotaped and shared with various media outlets across the state. The flood footage and information were used to help educate people of the effects from this devastating natural disaster. The hope is that the farmers will be able to come through one of the worst agriculture disasters to ever hit South Carolina and still have a viable business into the future.

The Agricultural Service Laboratory provides a variety of analytical agricultural testing for farmers and gardeners across the state so they know how to best fertilize their soil for optimal fertility. The Laboratory is a member and certified as a participant of the Agriculture Laboratory Proficiency Program for Soil, Plant, and Water Analysis Laboratories which provides quarterly exchanges of plant, soil, and water samples. In the year 2016, the Ag Service Lab analyzed 58,600 samples, including 1935 plant tissue, 790 feed and forage, 1836 animal waste, 669 irrigation water, and 35 compost samples.

Educational programs were conducted during the year pertaining to Plant Pathology, Herbicide Technology, Peanut Maturity Clinic, Agribusiness, Feeding Innovation, Business Planning for Agriculture and Healthy Food Access, Honey Bees & Insecticide Toxicology, Sprayer Calibration, Certified Crop Advisor, Organic Grain Production, Tobacco GAP training, and Small Farms and Backyards. Specialists hosted the 37th Annual SC Peanut Growers Meeting. Specialists created an instructional video on aflatoxin mitigation decision aid with Texas A&M as part of Risk Management Education grant. An agent participated in USAID work. Specialists prepared educational modules for the Certified Landscape Professional program. Farm Accounting and Financial Analysis training sessions were conducted for growers to learn how to gain confidence in understanding their own accounting data, be able to plan the farm business actions and to identify financial strategies for the farm business. Extension websites are available for those looking for information about extension software applications, enterprise budgets and distance education.

Clemson Extension Agents also developed a Farm Works field mapping course to provide farmers with insight on how to develop management zones and apply it in real world aspects to their fields.

2. Brief description of the target audience

Research and Extension activities in this program have the potential to benefit growers, state, federal and international agencies dealing with food production and distribution and with end users in countries around the world.

The target audience includes producers, Limited-Resource Farmers and Extension personnel, agency personnel, producers, master gardeners, and growers.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	42746	10543	213	50

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2016
Actual:	4

Patents listed

1. Electro-Mechanical controller for adjusting pump stroke on the go. 2 Automated Control Systems and Methods for underground Crop Harvesters. 3.Yield Monitor for Windrow-Collected Materials. 4. Round Bale Weighing Method and System.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	25	25

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Disclosures

Year	Actual
2016	2

Output #2

Output Measure

- Licenses

Year	Actual
2016	1

Output #3

Output Measure

- Number of people completing educational workshops

Year	Actual
2016	1004

Output #4

Output Measure

- New Variety Releases

Year	Actual
2016	2

Output #5

Output Measure

- Number of youth participating in 4-H food systems programs
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of people reporting increased knowledge in agronomic practices that are environmentally sensitive and economically efficient.
2	Number of youth gaining knowledge of food systems
3	Number of producers indicating adoption of recommended agronomic crop production practices
4	Number of Master Gardeners applying skills learned and reporting activities.
5	Number of people reporting increased knowledge in horticultural practices that are environmentally sensitive and economically efficient.

Outcome #1

1. Outcome Measures

Number of people reporting increased knowledge in agronomic practices that are environmentally sensitive and economically efficient.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of youth gaining knowledge of food systems

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2400

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Good food practices learned early on in life can mean the difference between healthy and unhealthy lifestyles for the consumer. Youth need to understand what the food systems means to them and how it affects their health.

What has been done
Extension agents taught educational programs on the global food web and food deserts. Youth participated in Jr. Master Gardening programs. They were able to experience gardening, from soil and seed and from the market to the table through gardening projects.

Results
4-H Community Gardening efforts alone have impacted some 2400 youth and families through active participation and community outreach. Youth learned recordkeeping, purchasing, storing, and planting knowledge and skills. Youth gained knowledge about where the food that they eat originates and about how the food system directly affects them and their communities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food

Outcome #3

1. Outcome Measures

Number of producers indicating adoption of recommended agronomic crop production practices

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	3949

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The proper timing of peanut harvest is one of the most important aspects of peanut production. Improper timing of peanut harvest can cause farmers to lose yield and profits. During the 2015 season, determining a digging date was extremely important due to the extreme drought experienced by the local producers throughout the summer, which resulted in several different stages of peanut maturity in fields across the area. Currently, the best solution to properly time peanut digging is proper monitoring of crop maturity.

What has been done
In early September of 2015, Clemson Extension Agents assisted farmers by conducting peanut maturity clinics and farm visits. At the clinics, the samples that were checked represented approximately 2,500 acres of peanuts. During the two month period, September and October farm visits were made to 25 farms with approximately 8,500 acres of peanuts. After determining the maturity of a field, the agent was able to recommend that the producer either start or delay digging the crop.

Results
Using a conservative estimate, it is easy to assume that the assistance with determining maturity and digging date saved producers 250 pounds of peanuts per acre. With the contract price of peanuts being $425 per ton for Virginia Type ($0.2125 per pound) and $385 for Runner Type ($0.1925 per pound) in 2015, these savings equal $53.13 or $48.13 per acre of peanuts, respectively.

4. Associated Knowledge Areas

KA Code	Knowledge Area
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #4

1. Outcome Measures

Number of Master Gardeners applying skills learned and reporting activities.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	454

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Horticultural Program at Clemson University seeks to inform consumers on environmentally sound horticultural practices that will improve communities.

What has been done
Examples of activities conducted by Clemson University Master Gardeners include answering questions at plant problem clinics, Ask-A-Master Gardener events, recycling days, community gardening support, speaker's bureau, and information booths local farmers markets. Volunteers worked as garden docents and serve on local boards. Agents developed online school gardening videos, hosted a statewide advanced master gardener training to teach school and community gardening concepts, and taught master gardener courses.

Results
Some 454 Master Gardeners contributed 103,697 hours of volunteer service through programs, oral presentations, newsletters, radio programs, and TV appearances. This represents a value of

$2,192,155 in program support.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
701	Nutrient Composition of Food

Outcome #5

1. Outcome Measures

Number of people reporting increased knowledge in horticultural practices that are environmentally sensitive and economically efficient.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	3599

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Sustainable Horticultural Production Program sought to improve profitability, increase efficiency, and reduce negative environmental impacts of horticultural cropping systems in South Carolina.

What has been done
Field trials were demonstrated. Agents established a broccoli cultivar trial involving 10 counties throughout the state, and participation from Clemson Research Farms, USDA, and growers. Spray trials were conducted to find the most effective insecticides to use on tomatoes. In addition, spray plans were developed for watermelon, corn, and squash. Growers received recommendations on planting and pruning, the identification and management of pests, safe calibration and use of pesticides, vegetable disease diagnosis, the protection of pollinators, organic certification process, the relationship of soil potassium to leaf tissue potassium as components of soil health, low input fruit for the farm or garden and how to start fruit orchards for you-pick operations.

Results

The Small Farm Projects with SC State University with Clemson's assistance resulted in $36,000 in savings due to improved fertility and pest management with some reporting a 50% increase in sales volume and a 25% increase in profit margin. Due to improved knowledge of tree management, pest management, and fertility management particularly in old orchards undergoing renovation, growers have saved or gained in better quality and yields approximately $47,500.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

After a drought-ridden summer, areas in South Carolina were already considered a disaster in terms of the production of certain crops. Many growers estimated at least a 40% yield loss on all crops from the drought alone. Then came the historic floods that occurred in South Carolina in October of 2015.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Due to improved knowledge and the use of best management practices for agronomic and horticultural crops, tree management, pest management, and fertility management, growers have gained in better quality and yields, as well as improved profitability. The impact in fruit production as a result of the grant-supported resistance testing program in strawberry yielded an economic impact of $250,000

Master Gardeners contributed 103,697 hours of volunteer service through programs, oral presentations, newsletters, radio programs, and TV appearances, which represented a value of $2,192,155 in program support.

Extension and research continue to evaluate on-going and completed research and programs.

Key Items of Evaluation

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

Childhood Obesity (Outcome 1, Indicator 1.c)	
4019	Number of children and youth who reported eating more of healthy foods.
Climate Change (Outcome 1, Indicator 4)	
0	Number of new crop varieties, animal breeds, and genotypes whit climate adaptive traits.
Global Food Security and Hunger (Outcome 1, Indicator 4.a)	
8010	Number of participants adopting best practices and technologies resulting in increased yield, reduced inputs, increased efficiency, increased economic return, and/or conservation of resources.
Global Food Security and Hunger (Outcome 2, Indicator 1)	
0	Number of new or improved innovations developed for food enterprises.
Food Safety (Outcome 1, Indicator 1)	
0	Number of viable technologies developed or modified for the detection and
Sustainable Energy (Outcome 3, Indicator 2)	
0	Number of farmers who adopted a dedicated bioenergy crop
Sustainable Energy (Outcome 3, Indicator 4)	
0	Tons of feedstocks delivered.