

**V(A). Planned Program (Summary)**

**Program # 1**

**1. Name of the Planned Program**

Global Food Security - Plant Production Systems and Health

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
201	Plant Genome, Genetics, and Genetic Mechanisms	10%	10%	8%	20%
202	Plant Genetic Resources	10%	10%	10%	10%
204	Plant Product Quality and Utility (Preharvest)	5%	5%	5%	10%
205	Plant Management Systems	13%	20%	12%	20%
206	Basic Plant Biology	10%	10%	10%	20%
211	Insects, Mites, and Other Arthropods Affecting Plants	10%	10%	10%	10%
212	Pathogens and Nematodes Affecting Plants	10%	15%	10%	0%
213	Weeds Affecting Plants	12%	15%	10%	0%
216	Integrated Pest Management Systems	5%	5%	6%	10%
404	Instrumentation and Control Systems	1%	0%	3%	0%
511	New and Improved Non-Food Products and Processes	1%	0%	2%	0%
512	Quality Maintenance in Storing and Marketing Non-Food Products	1%	0%	2%	0%
601	Economics of Agricultural Production and Farm Management	3%	0%	4%	0%
602	Business Management, Finance, and Taxation	3%	0%	4%	0%
604	Marketing and Distribution Practices	6%	0%	4%	0%
	<b>Total</b>	100%	100%	100%	100%

**V(C). Planned Program (Inputs)**

**1. Actual amount of FTE/SYs expended this Program**

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	102.0	9.0	160.0	7.0

Actual Paid Professional	133.0	21.0	155.0	8.8
Actual Volunteer	70.0	0.0	70.0	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
2083495	432247	2696052	884593
1862 Matching	1890 Matching	1862 Matching	1890 Matching
2083495	262374	2696052	235055
1862 All Other	1890 All Other	1862 All Other	1890 All Other
8090604	274134	19685752	67858

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

•Conduct discovery research on plants and plant systems using tools genomics, metabolomics, and proteomics

- Develop improved crop varieties using traditional and genomic approaches
- Introduce/discover new plants for food use and the green industry
- Develop systems for production of plants for biofuels
- Seek new uses for plants and plant byproducts
- Develop production systems for organic farmers
- Develop diagnostic techniques for indigenous and introduced pathogens
- Partner with industry
- Develop sustainable production systems for both large scale and limited resource farmers
- Enhance IPM programs through new techniques and strategies
- Set up applied research/demonstration plots
- Write papers for scientific community
- Prepare publications for grower and homeowner audiences
- Develop web sites to deliver information to grower and homeowner audiences
- Conduct workshops, meetings, and other focused educational programs for farmers, commodity groups, and industry.

**2. Brief description of the target audience**

- The scientific community
- Regulatory agencies
- Agricultural chemical companies
- Agribusiness
- Commercial and limited resource farmers
- New and Part-time farmers
- Homeowners
- Consultants
- News media
- General public
- Non-governmental organizations

- Other public agency staff

### 3. How was eXtension used?

Communities of Practice are available in eXtension for an array of field, horticultural and ornamental crops and related areas that provide a resource for producers, handlers, processors and marketers.

#### V(E). Planned Program (Outputs)

##### 1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	555000	1900000	0	0

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

###### Patent Applications Submitted

Year: 2013

Actual: 33

### Patents listed

Micropropagation of Alexandrian Laurel. Yang, G. and Z. Lu. U.S. Utility Patent Application No. 13/838,725

Compositions and Methods for Minimizing Nicotine Synthesis in Tobacco Appl # 13/521,766 US; also filed in Indonesia, Eurasia, Korea, Brazil, Hong Kong

Novel, Fast Acting Herbicide Produced From Plants  
Appl # 13/575,553 US

Deutzia 'NCDX1' Appl #Dec-48 Canada

Callicarpa 'NCCX1' Appl #Dec-47 Canada

Hypericum calycinum 'NCHC1' Appl # Dec-49 Canada

NCORNSP-016SCBG Ornamental Sweetpotato "Black Galaxy"  
Appl # 2012/2594 Europe

NCORNSP-017SCC Ornamental Sweetpotato  
Appl # 2012/2595 Europe

Alteration of tobacco alkaloid content through modification of specific cytochrome p450 genes Appl # 12199188.9 Europe

Peanut (Arachis hypogaea) N03081T Proposed name: Bailey  
Appl # 201000265 US

Root-knot nematodes encode diverse families of secreted peptides (12-50 residues) which mimic plant peptide hormones to elicit developmental responses in their host.  
Appl # PCT/AU2013/000022 International

Crop Resistance to Nematodes by Disrupting Host Plant Receptors of Cyst Nematode Secreted CLE Peptides  
Appl # 13/814,591

Transcription Factors (TFs) that Regulate Nicotine Biosynthesis in Tobacco Appl # 61/771,526 US

Burley Tobacco Inbred Lines and Hybrids TN90 SRC, Cms TN90 SRC, TN86 SRC, Cms TN86 SRC, NC7 SRC, NC775 SRC, NC645 SRC, NCBH129 SRC, NC638 SRC, Ky 14 x L8 SRC, Ky14 SRC, L8 SRC  
Appl # 61/772,786 US

Burley Tobacco Inbred Lines and Hybrids TN90 SRC, Cms TN90 SRC, TN86 SRC, Cms TN86 SRC, NC7 SRC, NC775 SRC, NC645 SRC, NCBH129 SRC, NC638 SRC, Ky 14 x L8 SRC, Ky14 SRC, L8 SRC  
Appl # 61/772,788 US

Burley Tobacco Inbred Lines and Hybrids TN90 SRC, Cms TN90 SRC, TN86 SRC, Cms TN86 SRC, NC7 SRC, NC775 SRC, NC645 SRC, NCBH129 SRC, NC638 SRC, Ky 14 x L8 SRC, Ky14 SRC, L8 SRC  
Appl # 61/772,792 US

Burley Tobacco Inbred Lines and Hybrids TN90 SRC, Cms TN90 SRC, TN86 SRC, Cms TN86 SRC, NC7

SRC, NC775 SRC, NC645 SRC, NCBH129 SRC, NC638 SRC, Ky 14 x L8 SRC, Ky14 SRC, L8 SRC  
Appl # 61/772797 US

Methods and Compositions for Plant Pest Control  
Appl # 61/780,395 US

Nanotechnology System for Agricultural Applications  
PCT/US2013/36746 International

Compositions and Methods for Blocking Ethylene Response in Plants Using 3-Cyclopropyl -1 -Enyl-  
Propanoic Acid Salt  
Appl # 12/669,600 US

Compounds Inactivating the Ethylene Receptor by Application in a Volatile or Non-volatile Form  
Appl # 1-2013-500814 Philippine

Use of a bio-pesticide for control of dollar spot and anthracnose in turfgrasses  
Appl # 13/906,498 US

NCTG-61 SRC, NC1562-1 SRC, NC196 SRC, K326 SRC, K346 SRC Flue-Cured Tobacco Lines and  
Hybrids  
Appl # 61/830,908 US

Release of NCPUR06-020, a purple-fleshed sweetpotato for the natural colorant industry.  
Appl # 13/986,824 US

Transgenic Plants Expressing Chloroplast Targeted Pyrococcus furiosus Superoxide Reductase  
Appl # 13/925,340 US

Methods and composition for improvement in seed yield  
Appl # 61/838,789

Compounds Amine Compounds Appl # 13/688,570

Transgenic Expression of Archaea Superoxide Reductase  
Appl # 61/838,817 US

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2013	Extension	Research	Total
Actual	27	272	299

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Studies conducted to identify new germplasm and develop new and improved varieties of crops and ornamentals

Year	Actual
2013	36

**Output #2**

**Output Measure**

- Clients to receive plant information via printed publications, fax, e-mails, phone and other contacts via known non-face to face delivery means.

Year	Actual
2013	1900000

**Output #3**

**Output Measure**

- Educate growers and other clientele through highly focused non-degree credit workshops and other formalized group educational sessions.

Year	Actual
2013	110359

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Increased Income as a Result of Production of New or Alternative Crops/Enterprises
2	Increased profit through the adoption of improved nutrient management practices
3	Number of releases of germplasm and varieties with improved yield potential and other qualities
4	New techniques and products developed and released that can be commercialized
5	Increased profit through the adoption of new production practices
6	More informed growers through highly focused non-degree credit workshops and other formalized group educational sessions.
7	Increased acreage of organic crops and specialty crops.
8	Number of discoveries of mechanisms that regulate the productivity of plants and the microorganisms that interact with them
9	Increased profit through the adoption of new production practices *and marketing locally*
10	New organic, farmers and agritourism markets established by individual entrepreneurs
11	Growers Adopting Improved Business Management Practices

## **Outcome #1**

### **1. Outcome Measures**

Increased Income as a Result of Production of New or Alternative Crops/Enterprises

### **2. Associated Institution Types**

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	33000000

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Increasing transportation costs and the rising price of fats and oils have made the current practice of importing large amounts of feed grains into North Carolina economically challenging to the state's poultry and swine industries.

#### **What has been done**

While increasing corn and wheat production, another promising solution is to increase sorghum production on marginal soils and to replace double-cropped soybean with double-cropped sorghum. Hybrid testing programs were conducted by NCSU researchers at six sites in North Carolina in 2013 along with crop management research conducted at three locations. Fourteen extension programs were conducted across NC, VA, and SC to provide growers with information on sorghum production and management. Five online agent training sessions were conducted to help train agents to assist first-time growers. At the end of the growing season five field tours were conducted to showcase hybrids and sorghum management practices that were resulting in maximum yield.

#### **Results**

Sorghum acres in North Carolina increased from 17,000 in 2011 to 100,000 in 2013. The result was 7 million bushels of grain sorghum produced in North Carolina in 2013. Assuming 75% of these bushels were the result of this program at the average sorghum price for 2013 of \$6.30 per bushel, this means that in sorghum income alone this program resulted in \$33.1 million dollars of additional revenue for the state.

#### 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
201	Plant Genome, Genetics, and Genetic Mechanisms
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

#### Outcome #2

##### 1. Outcome Measures

Increased profit through the adoption of improved nutrient management practices

##### 2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

<b>Year</b>	<b>Actual</b>
2013	15000000

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Educating farmers about optimum fertilizer management and production practices improves farm profitability and reduces the likelihood of runoff in state waterways. New fertilizer materials need to be evaluated for efficacy in commercial farms. And new large-scale processing facilities and farms represent major regional environmental concerns.

###### **What has been done**

Four research publications and corresponding training materials have been developed that provide information on everything from granular fertilizer spreader distribution pattern accuracy to drainage water management alternatives. Collaboration with various state agencies is ongoing to promote calibration of fertilizer and litter spreaders and more intensive management of water

control structures, as well as to offer crop problem diagnosis training for Extension agents.

### Results

Nitrogen fertilizer in the Tidewater region is predominantly applied to corn, wheat, cotton, and Irish potato; which account for approximately 29% of the statewide corn, 26% of the statewide wheat, 13% of the statewide cotton, and 95% of the statewide Irish potato acreages. If 50% of this area adopted best management practices (BMPs) such as nutrient management planning, then total Nitrogen runoff would be reduced by approximately 25%. If Nitrogen fertilizer use was reduced by even 10% on these farms, this would directly save farmers approximately 6.6 million pounds of Nitrogen, or \$3.3 million per year. Statewide, in excess of 1.3 million acres were documented under nutrient management plans to increase nutrient use efficiency and reduce nutrient losses.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants

### Outcome #3

#### 1. Outcome Measures

Number of releases of germplasm and varieties with improved yield potential and other qualities

#### 2. Associated Institution Types

- 1862 Research

#### 3a. Outcome Type:

Change in Condition Outcome Measure

#### 3b. Quantitative Outcome

Year	Actual
2013	22

#### 3c. Qualitative Outcome or Impact Statement

##### Issue (Who cares and Why)

Profitability for peanut growers is difficult to assess.

### **What has been done**

New cultivars have been developed and released for use by peanut producers in North Carolina, Virginia, and South Carolina.

### **Results**

Approximately 87% of the peanuts grown in North Carolina in 2013 were of three cultivars: Bailey, Sugg, and CHAMPS. Bailey and Sugg, two NC State cultivars, were released in 2008 and 2009. Bailey was the most commonly grown seed peanut in North Carolina in 2013 (53% of total certified peanut acres), followed by Sugg (26% of the total). In 2013, Bailey alone generated \$452,000 in royalties. Two new cultivars, Sullivan and Wynne, were released by the project in 2013. Both possess the patented high oleic fatty acid trait that extends the shelf life of those peanuts and products made from them.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants

## **Outcome #4**

### **1. Outcome Measures**

New techniques and products developed and released that can be commercialized

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Condition Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	10

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

There is a need for new technologies to maximize the quality and nutrient retention of shelf stable fruit and vegetable products and make such products economically viable in both retail and commercial (institutional) markets.

**What has been done**

Continuous flow microwave sterilization and pasteurization for processing and aseptic packaging of fruit and vegetable products has been designed, developed, extensively tested, validated and commercialized.

**Results**

The developed technology has received several U.S. and multiple international patents and has been licensed to several start-up companies in North Carolina, including Yamco, Aseptia, and Wright Foods. Continuous flow microwave processing of foods and biomaterials initiated by the program has emerged as one of the leading advanced thermal processing technologies in the world, and has been the first among microwave food sterilization technologies to be inspected and accepted by the FDA and commercialized by a North Carolina company.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants

**Outcome #5**

**1. Outcome Measures**

Increased profit through the adoption of new production practices

**2. Associated Institution Types**

- 1862 Extension
- 1890 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	30000000

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

The SmartFresh Quality System, developed and patented by NC State, maintains apple flesh firmness and fruit acidity much longer after harvest. However, the application of this product requires an air-tight facility for 24 hours with the cost being based upon the volume of the facility. Many North Carolina growers do not have a suitable facility and would benefit from an economical facility to treat smaller quantities of apples that can fluctuate with the seasonal volume changes.

#### **What has been done**

Because of work conducted at NC State in cooperation with the manufacturer and a blimp factory in Statesville, N.C., smaller retail growers now have the technology and research-based information to treat smaller quantities of fruit. Several workshops have been held in addition to educational programs at grower meetings, videos in production, and an instructional publication to educate growers on how to purchase or build an adequate treatment facility and effectively use SmartFresh.

#### **Results**

In 2013 a larger portion of the Southeast apple crop was treated with SmartFresh, resulting in a higher quality product for the consumer. In addition, the research-based educational material developed by NC State is now being used and distributed by the company nationally. Educational programs, grower trials and demonstrations across the state continued in 2013. The number of growers commercially using the product is increasing, and in 2014 the use in NC is expected to be much greater due to the number of facilities being constructed. The maintenance of fruit quality realized with SmartFresh resulting in increased sales and allowing apples to be sold in higher value markets could contribute 10% to the value of the approximate \$25 million dollar apple industry totaling more than \$2 million annually.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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

#### **Outcome #6**

##### **1. Outcome Measures**

More informed growers through highly focused non-degree credit workshops and other formalized group educational sessions.

##### **2. Associated Institution Types**

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

### 3a. Outcome Type:

Change in Knowledge Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2013	183932

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Small-scale produce farmers are constantly searching for new methods and varieties to extend the growing season and maximize profit. High-tunnel greenhouses and plastic mulch are used to extend the growing season, increase crop yields, improve quality, and generated additional net farm income. The greenhouses will also continue to help these farmers expand their produce operations.

#### What has been done

To assist these farmers, Bladen, Duplin, Sampson, and Robeson County Cooperative Extension provided an educational workshop showcasing the benefits of high-tunnel greenhouses and plastic mulch.

#### Results

A total of 28 participants attended the workshop. Evaluations revealed 90% of participants expressed an interest in high tunnels or will install a greenhouse on their farm. Since the completion of the workshop, nine participants have installed high-tunnel greenhouses, which will generate approximately \$18,430 combined extra income in year one. Statewide, more than 2,300 growers enhanced marketing of farm products locally, resulting in more than \$3 million in additional income.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
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

## **Outcome #7**

### **1. Outcome Measures**

Increased acreage of organic crops and specialty crops.

### **2. Associated Institution Types**

- 1862 Extension
- 1890 Extension

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	500

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

With rising demand for stevia production (an alternative plant sweetener) in North Carolina, more farmers are taking on this specialty crop but lack the knowledge of best production practices.

#### **What has been done**

A workshop on stevia production took place in Merry Hill, N.C., in July 2013. This workshop was attended by 43 farmers, Extension personnel, and other farm advisers. The university's Organic Grain Field Day also highlighted stevia production and included a tour of the stevia research trial.

#### **Results**

More than half of the participants who were evaluated after the workshop said they plan to grow stevia, and all said they learned new information during the workshop. At least three farmers are growing stevia because of this project, producing approximately 113,094 kg of stevia (leaf and stem) valued at \$68,135.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

## **Outcome #8**

### **1. Outcome Measures**

Number of discoveries of mechanisms that regulate the productivity of plants and the microorganisms that interact with them

### **2. Associated Institution Types**

- 1862 Research
- 1890 Research

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	14

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Pesticide contamination from both insecticides and herbicides can have very adverse effects on the environment and human health, especially for rural communities that depend on wells for their domestic and agricultural water supply.

#### **What has been done**

Management of vegetable pests of cowpea, tomato, eggplant, collards using sustainable and safe approaches included biorational pesticides (Agroneem, Azatin, Neemix, Spinosad) and a low risk synthetic neonicotinoid, imidacloprid (Pravado)thiamethoxam (Actara) was evaluated for their effectiveness and impact on natural enemies.

#### **Results**

Safer and more effective pesticide products (Azadirachtin-derived biorational and Spinosad) were identified and are available for use on vegetable crops. The best management practice for multiple pests on collards was found to be a mixture of spinosad (good for caterpillars) and Actara (good for sucking pests except mites).

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources

204	Plant Product Quality and Utility (Preharvest)
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants

## **Outcome #9**

### **1. Outcome Measures**

Increased profit through the adoption of new production practices \*and marketing locally\*

### **2. Associated Institution Types**

- 1862 Extension
- 1890 Extension

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	2000000

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

The long-term success of North Carolina's local food movement is dependent upon an influx of new and transitioning farmers.

#### **What has been done**

The Center for Environmental Farming Systems (CEFS), through the Bringing New Farmers to the Table project's Incubator Farm Project, worked closely with four community organizations throughout North Carolina, providing planning and technical assistance as they design and implement new incubator farms to support new farm enterprise development. Through the Bringing New Farmers to the Table project in 2013, CEFS has also engaged with ten other North Carolina-based and national communities/organizations interested in supporting new and beginning farmers.

#### **Results**

The project has supported development of new opportunities for access to land and training resources for new farmers in North Carolina and is enabling entrepreneurial farmers to overcome barriers to business development. Through CEFS' planning support, two new NC incubator farms were implemented in 2013: the Onslow County Incubator Farm and the LINC Urban Farm. The Hines Chapel Preserve Incubator Farm received final county approval for use of public land and is moving toward implementation. The Town of Robbins Incubator Farm made significant strides in planning and feasibility evaluation in 2013 and will continue with planning in 2014. Statewide, Extension programs documented almost 60,000 people who reported growing food for home

consumption, producing food valued at \$6.25 million.

#### 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
205	Plant Management Systems

#### Outcome #10

##### 1. Outcome Measures

New organic, farmers and agritourism markets established by individual entrepreneurs

##### 2. Associated Institution Types

- 1862 Extension
- 1890 Extension

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	1147

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

The state of North Carolina has seen a recent boom in the number of craft brewery establishments and along with it, a rising demand for locally grown hops.

###### **What has been done**

In order to meet the demand of growers and answer important questions about varieties, growing conditions, pest and disease issues, fertility and general hop production, a research variety trial was developed at the Mountain Horticultural Crops Research Station in 2011. A website, blog and Facebook page also were created to support the program, which also advised growers on variety performance and cultivar selection and developed new guidelines pertinent to growing hops in this region. Fertility recommendations have been developed, and there is now a code for hops on soil sampling reports.

###### **Results**

Local growers have benefited from the research at NC State as one of the only sources of information in our area, and they continue to depend on the information we generate. The number of breweries across the state continues to increase, and three large, national breweries recently expanded to establish operations in the mountains of western North Carolina. The number of hops growers also continues to rise. On a different front, programs in organic grain production

systems have supported a number of growers to begin producing malting barley.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
604	Marketing and Distribution Practices

#### Outcome #11

##### 1. Outcome Measures

Growers Adopting Improved Business Management Practices

##### 2. Associated Institution Types

- 1862 Extension
- 1890 Extension

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	16000

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Increasingly, fresh produce buyers are requiring growers to obtain Good Agricultural Practices (GAPs) certification. Growers who have not obtained GAPs certification face a limited market and potentially diminished profitability.

###### **What has been done**

In order to assist growers in becoming GAPs certified, a targeted training program was developed to give fresh produce growers the information and skills they need to implement Good Agricultural Practices on their farm, navigate the USDA GAPs audit process, and provide hands-on assistance in developing a food safety plan.

###### **Results**

Eight workshops were presented in 2013, reaching a total of 122 participants. As part of beta testing, online trainings were released to 65 of the workshop attendees. Equipped with the skill set needed to complete the GAPs certification process, growers will have the capability to open markets previously closed to them, thus potentially increasing net farm income. Statewide, a total of 1,084 individuals were certified in GAPs or GHPs and/or developed food safety plans.

#### 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
604	Marketing and Distribution Practices

#### 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

##### Brief Explanation

Rapidly changing environmental and economic conditions (weather extremes, economic climate) influence producers' abilities to adapt to change while ensuring sustainable production systems. Continued effects of the economy on federal, state and local support for research and extension programs continue to challenge our research and extension enterprises. Likewise, regulatory and other governmental policies and rules influence the educational and research capacities of our programs and present challenges to producers, processors and marketers to comply with new and often expensive regulations. And in an environment of reduced funding, the program competition for existing funds becomes a greater challenge to manage. Nevertheless, emphasis is placed on those research and extension opportunities that have the greatest effect on sustainability of farms, families and businesses, i.e., economic, environmental, social and quality of life benefits.

#### V(I). Planned Program (Evaluation Studies)

##### Evaluation Results

Outcomes and impacts determined from our research and extension programs support the principle that our programs engage a wide array of users across the state, help support enterprise and marketing change (feed grains initiative), involve integration of research and extension efforts, and create significant economic value to the state in terms of added value from innovations in agricultural production, costs saved and enhanced marketing approaches. In addition, our research and extension enterprises represent productive environments in which our faculty are productive in terms of peer reviewed

publications and creation of intellectual properties.

### **Key Items of Evaluation**

We are continually challenged to keep evaluation principles and tools aligned with plans of work, program implementation practices in the field, and outcome observations so that we can effectively report the results of our efforts.

We are proud of the many accomplishments of this program. A couple examples:

The swine industry, NCSU, NC Department of Agriculture, NC Biotech Center collaboration that spent around \$750,000 for research and education to stimulate feed grain production. Not counting increased corn and wheat production, additional grain from sorghum, which was promoted in the program, in just one year was worth an estimated \$33 million.

Our plant breeding programs for sweet potatoes and peanuts have a record of generating new varieties that become the predominant varieties used by the industry in a matter of just a few years after release. 'Covington' sweet potato and 'Bailey' peanut are two notable cultivars.