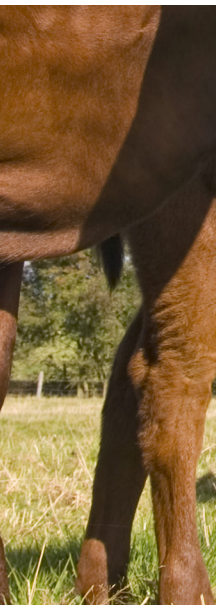
RESEARCH STATIONS ANNUAL REPORT

2014



North Carolina
Department of Agriculture
& Consumer Services

North Carolina State University
College of Agriculture
& Life Sciences

NC A&T State University
School of Agriculture
& Environmental Sciences

OUR MISSION

The mission of the Research Stations in North Carolina is "to manage crop and livestock facilities at research stations to support agricultural research, extension and teaching programs conducted by land grant university faculty across the state." Research Stations in North Carolina are operated in a unique partnership among the North Carolina Department of Agriculture and Consumer Services (NCDA&CS), NC State University (NCSU), and NC A&T State University (NCA&T). It is the job of the Research Stations to provide the research platform for innovation and discovery to bolster and grow the $78 billion industry that is North Carolina agriculture. Moreover, this innovation and discovery makes global contributions to food production and security.

AGRICULTURAL RESEARCH IS THE KEY

The North Carolina Research Stations are on the front lines of meeting this challenge. North Carolina is uniquely situated to be at the forefront of agricultural advances that will feed current and future generations. Along similar latitude, the Research Stations in North Carolina offer a wide variety in soils, climate, and cropping systems. Our diversity makes us an extremely attractive place in which to push the bounds of agricultural productivity through research. World-class faculty at NC State and NC A&T lead the way as new technology, crop varieties, better utilization of available resources, and gaining every possible efficiency is the focus of agricultural research on North Carolina's Research Stations.

NORTH CAROLINA IS INVESTED IN AGRICULTURAL RESEARCH

With its 18 research stations and incredibly diverse soils and climate, its world-class research faculty at NC State and NC A&T, and its proximity to Research Triangle Park, North Carolina is uniquely suited as hotbed for research in agriculture. North Carolina is a top 10 agricultural state in terms of cash receipts from farming. Of those top 10 states, only Texas has more off-campus research stations than North Carolina. And, it is a wise investment. **According to a 2011 study published by the University of California-Davis, there is a $19.90 return on every $1.00 of public funds spent on agricultural research in North Carolina over the life of the technology created.**

IMPACT SNAPSHOT OF RESEARCH STATIONS

With its critical mass of faculty and research stations, new information and technology to benefit North Carolina farmers is generated daily. It is impossible to list all new and exciting things that come from agricultural research efforts in North Carolina. To provide a glimpse, here are four examples of exciting research outcomes:

- NC leads the nation in sweet potato production and 93% of the NC sweet potato acreage is planted to Covington, a variety developed on NC Research Stations. Moreover, the sweet potato breeding program is the world's leader and recent recipient of a Bill and Melinda Gates Foundation grant to develop sweet potatoes to alleviate world hunger and food shortages.
- NCSU researchers in the College of Agriculture and Life Sciences released 22 plant varieties, most of these releases involved work at multiple research stations.
- College of Agriculture and Life Sciences researcher's published 837 refereed journal articles, a significant number of these articles contained data derived from research conducted on research stations.

In 2009, the Research Stations initiated a strategic planning process in which four main goals were identified as critical to meeting the mission. The progress fin 2014 for each goal is summarized, with some key highlights in this report.

EXECUTIVE SUMMARY

In 2009, the Research Stations initiated a strategic planning process in which four main goals were identified as mission critical. Progress for each goal in 2013 is summarized in this report. Key highlights include:

Over FY 13-14 and FY 14-15, $5 million was appropriated for research stations to upgrade equipment. By the end of 2014, research stations had acquired 136 new pieces of equipment valued at $5.52 million. The appropriation was leveraged with trade-ins to maximize purchasing power.

It was recognized that there is a greater potential for beef cattle research in our state if resources at stations could be combined, leveraged and treated as a single, state-wide beef research herd. A plan initiated in 2013 was continued to build a state-wide herd and maximize resources so that individual stations could serve as specialty areas for specific research. The enhancement and reorganization is revitalizing beef research in North Carolina. This is positioning our state to be a regional and national leader in beef research.

At the direction of the General Assembly, Research Stations has been tasked with supporting the developing bioenergy industry in North Carolina. Four staff has been hired to oversee the program and to provide technical support for research in bioenergy crops. Two separate competitive grant cycles totaling $1.5M have been awarded for bioenergy research in NC and a successful Bioenergy Field Day was held to showcase new and ongoing research with over 100 attendees.

The research stations began managing on a regional model to gain efficiencies and facilitate the sharing of resources. Collaborations among research stations in the Eastern Region and the Western Region have resulted in greater research capacity and streamlined management. A dedicated safety officer for each region was hired and more training and greater hazard awareness has resulted in a decrease in the number of workman's comp claims compared with previous years.

Strategic partnerships between NCDA&CS, NC State, USDA-ARS, and state commodity groups has resulted in station upgrades, improvements and increases in overall research capability.

Over 10,000 individuals participated in events hosted at research stations statewide. Activities are diverse and include field days, extension programs, and other community outreach events.

FEEDING THE WORLD BY 2050

World population is projected to reach 9 billion by the year 2050. In order to meet the demand of the world's bourgeoning population, food production will have to at least double over the next 36 cropping seasons. Food security quickly becomes a national security issue when scarcity occurs. So, the challenge of feeding the world's growing population is critical to a healthy, prosperous, and stable state, country, and world.

Our Goals

Goal 1: Enhance Infrastructure for High-Quality Applied Agricultural Research
Goal 2: Ensure Efficient Research Station and Farm Management
Goal 3: Enhance Working Relationships and Communication
Goal 4: Strengthen Outreach, Extension and Education

GOAL 1: ENHANCE INFRASTRUCTURE FOR HIGH-QUALITY APPLIED AGRICULTURAL RESEARCH

- **New Equipment for Research Stations:** The 2013 General Assembly made an investment in agricultural research in North Carolina. It was recognized that the research stations across the state had an aging fleet of equipment and needed to be outfitted with the most modern equipment possible for high quality, precise, and relevant research. An appropriation of $5 million was made for the research stations to upgrade equipment of the next two fiscal years.

  The 2014/15 fiscal year is the second year of the two-year appropriation. By the end of calendar year 2014, the Research Stations acquired several new pieces of high-tech agricultural equipment to enhance research capacity. An emphasis in 2013 was on motorized equipment such as tractors and sprayers because of the age and inefficiency of the existing fleet. While those remain a priority, focus shifted in 2014 to items such as planters, horticultural equipment, and irrigation systems with the latest technology. The precision and efficiency of this newer equipment will further research efforts and capability in seeding and management of field and horticultural crops. Enhancements such as variable frequency drive (VFD) pumps for irrigation systems will allow for extremely precise control of irrigation water output for maximum efficiency and research capability.

- **Precision Ag Investment:** Building on investments from previous years, more technology has been deployed on the stations resulting in greater precision, more efficiency, and more relevant research to support the high-tech agricultural industry. In 2014, the Research Stations acquired 16 new auto-steer tractors, which allow for GPS-controlled planting and application of fertilizer and crop protection chemicals. The systems are fully integrated into research station record-keeping and data collection systems to enable the automated flow of information from tractor to office and vice-versa.

- **Enhancement of the Beef Cattle Research Resources in North Carolina:** North Carolina's beef cattle enterprises contributed more than $334 million in cash receipts in 2012. In conjunction with the Animal Science Department at NC State, the NC Cattlemen's Association, and several industry partners, an ambitious plan to reorganize the beef research capability in North Carolina was begun in 2013.

  By utilizing all of the land and cattle resources across the Research Stations, the plan endeavors to position NC as the premier beef research state east of the Mississippi. Specific goals are to

  - Across the State, six research stations are involved in beef cattle research. Each had a resident cow-calf herd. It was recognized that there was greater potential for beef cattle research if these resources could be combined, leveraged, and treated as a single, state-wide beef research herd. 1) build a state-wide beef research herd with a common genetic background to remove variability in research, and 2) move cattle within this new system such that individual stations could serve as specialty areas for certain types of research. In this manner, larger numbers of animals could be utilized for research and efficiencies could be gained by taking advantage of the unique climates and resources already in place on the six stations involved in beef research. Moreover, the national competitiveness of North Carolina beef researchers is greatly enhanced because of larger numbers and more leverage for grant funding.
  - Utilizing embryo transfer technology and artificial insemination technology with known genetics, progress has been made toward building a 650-700 head herd of research cattle in the most economical way possible. It is expected that the cross-bred herd at the Mountain Research Station will be transitioned to a registered Angus research herd by the middle of 2016. Similar progress is being made at other locations.
  - To accommodate the larger, more uniform herd grazing capacity is increasing at Umstead Research Farm and the Tidewater Research Station, while enhanced controlled grazing through cross-fencing improvements at the Upper Mountain Research Station were accomplished.
  - The improvements to the NC Beef Research platform have gained considerable attention from cattlemen and industry partners. For the first time in over 20 years, an NC Beef Field Day was held at the Butner Beef Field Lab on a Saturday in August with over 300 in attendance. Industry groups from the American Angus Association to those promoting research on farm-to-fork grassfed beef in NC have become partners in the endeavor.

- **Training programs:** While investing in equipment is important, our people are our greatest resources. Research Stations staff from all 18 stations have taken part in professional development opportunities and will continue to do so. In 2014, two research station superintendents were invited to give presentations at national meetings to their peers from research station systems around the country. Numerous research technicians and specialists attended trainings, seminars, and conferences related to their work area, such as the Southeast Vegetable Growers Conference, and the Beltwide Cotton Conferences. Many serve on local and statewide boards. The Research stations will continue to invest in its people so that we not only keep current, but are leaders in the development and use of newer and greater technology.

- **Forestry Program:** The forest management program generated over $400,000 during the year from timber and pine straw harvesting. With approval of the General Assembly, a portion of the funds generated supported the following projects: $200,000 – Greenhouse Expansion (Tidewater); $150,000 – Calf Barn Construction (Piedmont); $150,000 – Forest Road Construction (Tidewater)

- **North Carolina Bioenergy Research Initiative:** The 2013 General Assembly appropriated funds to the Research Stations for the purpose of supporting the developing bioenergy industry in North Carolina. In early 2014, the division will begin its first cycle of awarding research grants targeted specifically to develop the knowledge base and infrastructure for producing feedstocks from crops and forest products for the production of cellulosic ethanol. A second grants cycle is expected in the second half of 2014. Staff have been hired to oversee this program and provide technical support for research in bioenergy crops. Additionally, Research Stations have assumed the administration of 17 grant-funded research projects formally managed by the Biofuels Center of North Carolina. These existing and new projects are expected to provide the knowledge base needed to grow the biofuels industry in North Carolina.

GOAL 2: ENSURE EFFICIENT RESEARCH STATION AND FARM MANAGEMENT

Research is conducted on over 80 commodities produced in North Carolina.

We are one of the most diverse agricultural states in the nation which is supported by the research being conducted at our 18 research stations.

By the Numbers:	
Research faculty at NC State, NC A&T, and USDA working on NC Research Stations	**113**
Research projects conducted across the system	**533**
Graduate students working on and receiving training on the research stations	**153**
Acres devoted to small-plot research (not including land for forages)	**1917**
Field days, seminars, and other training and educational events	**143**
Number of attendees at field days, seminars, and other training and educational events	**10,270**

Regional Management: In 2014, the Research Stations continued to utilize a regional management approach that takes advantage of the diversity and connectedness of the system. Where possible, both labor and equipment resources are shared and coordinated for maximum efficiency. Just as important, the regional approach has allowed some staff to specialize in certain areas and become a resource upon which multiple stations can call. An example is the precision ag technology where some research technicians and specialists have been able to quickly learn and train other stations in its use. Management has openly encouraged this form of professional development and sharing of talent.

Safety: The safety and welfare of our employees is a paramount concern. Moreover, agriculture is an occupation with numerous hazards. Recognizing these realities, as well as the high cost of workman's compensation claims, the Research Stations re-allocated two vacant positions to Safety Officers in December of 2013. The Safety Officers work as a team with one primarily in Eastern NC and one in Western NC. The goal is for Research Stations' safety program to be proactive in hazard recognition and avoidance, training, and responsiveness to safety-related issues rather than just being a "check the box" program. The investment has paid off with fewer workman's compensation claims in 2014. Continued investment in safety can be expected in 2015.

GOAL 3: ENHANCE WORKING RELATIONSHIPS AND COMMUNICATION

In recent years, NC A&T and NC State have been forging a closer partnership, in accordance with directives coming from the National Institute of Food and Agriculture (NIFA) for land-grant universities within the same states to collaborate on research and Cooperative Extension projects.

As a result, eight combined research initiatives from the NC A&T-NC State Research Partnership were developed in 2012. In July of 2013 a combined NC A&T/NC State Research Collaboration Meeting was held. Working groups around these initiatives were formed and members from both NC A&T and NC State began exploring opportunities and barriers to producing positive impacts in those areas.

Relationship with NC State Administration	Administration at NCDA&CS and NCSU meet at least monthly to facilitate effective management and strategic decision-making.
Advisory Groups	Faculty Advisory Committees were formed for each Research Station in 2013 and continued to function in 2014. The role of the advisory committees is to further enhance communication between research faculty and research stations as it relates to strategic planning and utilization of resources and facilities to ensure the research needs of faculty are being met.
Partnerships	Strategic partnerships between NCDA&CS, NC State, USDA-ARS, and commodity groups resulted in station upgrades, improvements, and overall research capability.
Center for Environmental Farming Systems (CEFS)	The Cherry Research Farm continues to be a springboard for statewide initiatives such as the 10% campaign aimed at increasing consumption of NC products.
Multi-State Projects	• Research stations host a number of multi-state projects such as the SUNGrains breeding initiative for wheat, oats, and barley as well as a integrated pest management programs. • The relationship with Virginia Tech's Agricultural Research and Extension Centers (ARECs) continues to grow. In 2014, NC Research Station superintendents took part in a summer meeting in Virginia with their counterparts. • The Director of the Research Stations was invited to be part of two out-of-state external review teams which provided an independent review of experiment station programs at the University of Tennessee and Virginia Tech.

GOAL 4: STRENGTHEN OUTREACH, EXTENSION AND EDUCATION

Field Days

- Research Stations hosted field days focused on beef, cotton, peanuts, tobacco, reduced tillage, small fruits, tree fruits, hay, and many other commodities.

- Visitors to the Research Stations in 2014 were able to ride in trams, or people movers, purchased in 2013 as they learned about agricultural research ongoing at the stations. The trams conform to all safety standards and ensure a comfortable, safe experience for visitors to our research stations while reducing the state's liability. Moreover, they are able to be easily towed between stations for use where needed and when needed for citizens of the State to enjoy events on the Research Stations. The trams have become so popular and in demand around the state that four additional trams were purchased in 2014, bringing the total to 11.

- Partnerships with Cooperative Extension and Research Stations were strengthened in 2014. Multiple training events were held for Extension at research stations. A concerted effort was made to more closely involve Cooperative Extension in field days while providing a training opportunity for Research Station and Extension Staff. Researchers and Specialist were engaged in the planning process for field days to provide training for Extension Agents and Research Station staff with the goal of both being able to provide more of the content for research station attendees. Notable successes were the number of Extension Agents and Research Staff making presentations at the Small Grains and Beef field days.

Ag and Science Teachers

- Rowan County High School Ag Teachers have students participating in applied research programs at Piedmont Research Station focused on strawberry production with Dr. Jeremy Pattison of NC State.

- Central Crops Research Station is working with a teacher and student from Clayton High School to collect 14 soil monoliths which will be preserved and utilized for future soils classes.

- The Northeast Region Biotechnology/Agriscience High School completed its second year in the Vernon James Center located at the Tidewater Research Station in Plymouth. The school currently has 60 students who are provided the opportunity to interact with researchers located at the James Center in addition to their traditional classes. Beginning in the fall of 2014, the school is meeting in Jamesville. However, several days during the week, students are on the Tidewater Research Station in a learning environment with NC State faculty and Research Station staff.

SNAPSHOTS OF AGRICULTURAL RESEARCH IMPACTS

The following are quotes from NC State Research Faculty that illustrate the importance of the Research Stations to agriculture research and moving agriculture forward in North Carolina:

"With significant funding from partners, research and extension/technical assistance programs were associated with the production of 60,000 new acres of grain sorghum with an estimated value of over $30 million. The research stations played a significant role in the grain sorghum testing program and hosted field days displaying this research."

"Two new high yielding peanut varieties (Bailey and Sugg) over a two year period will represent almost the entire crop produced in the VA-CAR production area. The increased yields and value of these new varieties has already generated an estimated $16 million benefit to growers compared to existing varieties. Research stations play a significant role in the breeding of new peanut varieties as well as the breeding programs in other crops. Indeed, an estimated 40% of the capacity of research stations is devoted to plant breeding projects."

"Approximately 99% of the cotton grown in North Carolina is planted to herbicide-resistant cultivars. Research has focused on determining the most effective and cost efficient systems for weed control, including herbicide resistant weeds. Yields have increased, input costs have remained the same or been reduced, and quality problems such as foreign matter contamination have been reduced. The overall value to North Carolina cotton producers is estimated at $25 million. Research stations play a critical role in the testing and development of weed control strategies. This year the Upper Coastal Plain Research Station hosted over 400 at the Cotton Field Day where growers were informed of the most current research results."

Mountain Horticultural Crops Research Station. Photo by Marc Hall.

"Based on research with byproduct feeds, 10,000T of soybean hulls, 6,000T of dry corn gluten feed, 8,000T of wet corn gluten feed, and 10,000T of other byproducts were utilized by beef cattle producers, for a realized feed savings of over $1 million. Research stations played a significant role in research projects on byproduct feeds. To continue this progress, the stations are engaged in a beef cattle re-organization program that will increase the overall efficiency of the beef cattle program."

"Research with broilers confirmed that strategic addition of a limited amount of larger particles of corn to pelleted broiler feed improves overall digestive efficiency and reduces litter nitrogen, phosphorus, and moisture. Improved feed efficiency will contribute over $600 million to the U.S. broiler industry while improving environmental sustainability. These results would not have been possible without the specialized animal testing facilities and the dedicated employees who conduct the research."

NORTH CAROLINA RESEARCH STATIONS

** Items in bold are primary reasearch interests*

BORDER BELT: Field Crops (**Tobacco**, Soybeans, Corn, Peanuts, **Small Grains**)

CASWELL FARM: Field Crops (**Soybeans**, **Corn**, Wheat), **Organic Crops** (Soybeans and Cotton), Invasive Weed Ecology, Native Grasses

CENTRAL CROPS: Field Crops (**Corn, Soybeans, Cotton**, Small Grains), Tobacco, Swine, Horticultural Crops (Melons, Peaches, Apples, **Strawberries**, Sweet Potatoes, Squash), Canola

CHERRY FARM: **Grass-based Dairy**, Beef, **Antibiotic-free Swine**, Corn, Soybeans, Cotton, **Specialty Crops**, Organic Farming, Goats, Wetlands Restoration, Waste Composting, Riparian Buffers

CUNNINGHAM/LOWER COASTAL: Tobacco (**Flue-cured**, Burley, Dark Air-Cured), Horticultural Crops (Brambles, **Melons**, Watermelons, **Sweet Potatoes**, Lettuce, Cabbage, Squash, Cucumbers), Corn

HORTICULTURAL CROPS, CLINTON: Horticultural Crops (**Cucumbers**, Melons, **Sweet Potatoes**, **Peppers**, Blueberries, Grapes, Strawberries, Watermelon, Tomatoes), Field Crops (Soybeans, Corn)

HORTICULTURAL CROPS, CASTLE HAYNE: **Blueberries,** Strawberries, Grapes, Cucumbers, Watermelon, Woody Ornamentals, Woody Fruit Species, **Sea Oats**, **Coastal Beach Grass**

MOUNTAIN: Specialty Crops, Christmas Trees, **Heirloom Tomatoes**, Forages, **Beef**, Wheat, Corn, **Burley Tobacco**, Alternative Crops

MOUNTAIN HORT: **Tomatoes**, Ornamentals, **Apples**, Peaches, Strawberries, Blueberries, Brambles, Peppers, Cucurbits, Soybeans, Corn, **Aquaculture**, **Greenhouse Production**

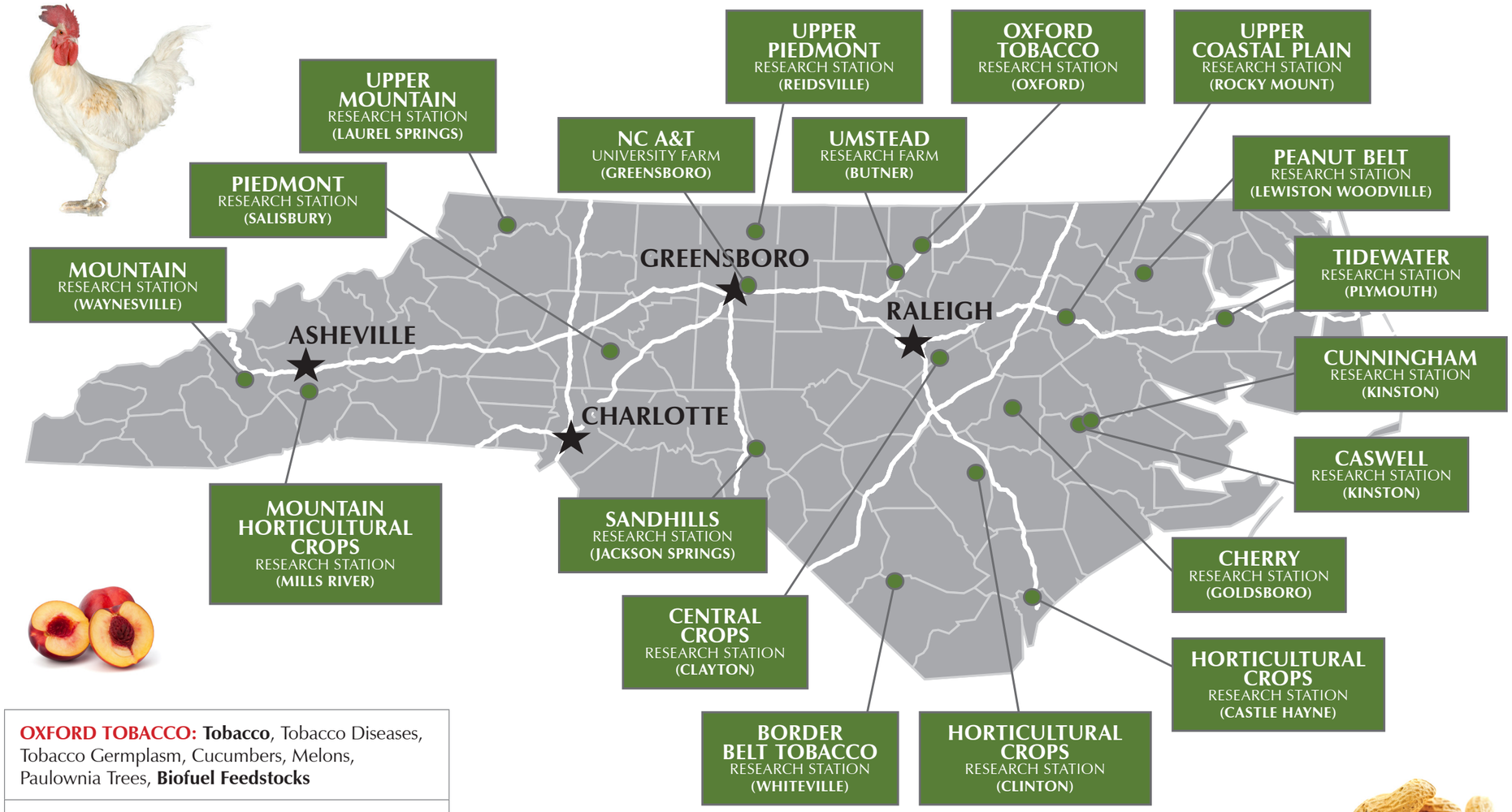
OXFORD TOBACCO: **Tobacco**, Tobacco Diseases, Tobacco Germplasm, Cucumbers, Melons, Paulownia Trees, **Biofuel Feedstocks**

PEANUT BELT: **Peanuts**, **Corn**, **Cotton**, Wheat, Soybeans, Cucumbers, Melons, Snapbeans, Sorghum, Sage, Fescue

PIEDMONT: **Poultry**, **Dairy**, Corn, Soybeans, Hay, **Small Grains**, Wheat, Tomatoes, Strawberries, Caneberries, Blueberries, **High Tunnel Production**

SANDHILLS: **Peaches**, Blueberries, **Turfgrass**, Corn, **Soybeans**, Caneberries, Peppers, Strawberries, Ornamentals, Peanuts, Sweet Potatos, **Cotton**, Rye

TIDEWATER: **Soybeans, Corn, Cotton,** Aquaculture, **Swine**, **Beef**, **Irish Potatoes**, Rice, Canola, Sweet Sorghrum, Small Grains



UMSTEAD: **Forestry**, **Water Quality**, Biofuel Feedstocks, Weed Management, **Forage Production**

UPPER COASTAL PLAIN: Peanuts, **Cotton**, Soybeans, Corn, **Tobacco**, Cucurbits, Small Grains, Switchgrass, Trees, **Weed Management**

UPPER MOUNTAIN: **Beef**, Goats, Christmas Trees, Strawberries, **Brambles** (Raspberries, Blackberries), Blueberries, **Burley Tobacco**, Small Grains, Mushrooms, Organic Crops, Ornamentals

UPPER PIEDMONT: Grapes, **Beef**, **Tobacco (Flue-cured**, **Burley** & **Dark)**, Paulownia Trees, Wheat, Canola, Biofuel Feedstocks, Turf, **Meat Goats**

A&T UNIVERSITY FARM: Swine, Poultry, **Specialty Crops**, Organic Crops, Goats, **Waste Management**, **Constructed Wetlands**, Soil Quality

NORTH CAROLINA RESEARCH STATIONS

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