



RESEARCH STATIONS ANNUAL REPORT

2015



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 Division in North Carolina is “to manage crop and livestock facilities at research stations to support agricultural research, extension and teaching programs conducted by university faculty across the state.” To that end, the research stations provide the testing ground for innovation and discovery that undergirds the \$76 billion industry that is North Carolina agriculture. Moreover, this innovation and discovery makes national and international contributions to food production and food security.



AGRICULTURAL RESEARCH IS THE KEY

The Research Stations Division is 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 N.C. State University and N.C. A&T State University lead the way, focusing our stations’ agricultural research on new technology, improved crop varieties, better utilization of available resources, and increased production efficiency.

NORTH CAROLINA IS INVESTED IN AGRICULTURAL RESEARCH

With its 18 research stations and incredibly diverse soils and climate, its world-class research faculty at N.C. State and N.C. A&T, and its proximity to Research Triangle Park, North Carolina is situated as a hotbed for research in agriculture. North Carolina is a top-10 agricultural state in terms of cash receipts from farming. North Carolina is unique in that its research stations are a partnership of both the N.C. Department of Agriculture and Consumer Services and N.C. State University, College of Agriculture and Life Sciences. 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 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 percent of North Carolina’s sweet potato acreage is planted with the Covington variety, which was developed on state research stations. Moreover, the sweet potato breeding program at NCSU 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 18 plant varieties in 2015; most of these releases involved work at multiple research stations.
- In 2015, NC State’s College of Agriculture and Life Sciences researchers published 936 peer-reviewed 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 in 2015 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 2015 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. Over the two-year appropriation, the Research Stations acquired \$7.79M of new equipment. This was done by leveraging the trade-in value of outdated equipment as well as some self-generated receipts. In total, 165 pieces of modern agricultural equipment were acquired for supporting agricultural research across North Carolina. These included tractors, planters, irrigation equipment, harvesters, utility vehicles, and more which greatly enhances the capacity, precision, and relevance of agricultural research on the Stations.

Building on previous years’ efforts to improve the beef cattle research platform in North Carolina, embryo transfer (ET) from the superior cattle at Upper Piedmont Research Station near Reidsville continues to be the primary method of establishing uniform genetics among all of the resident herds. The goal continues to be genetic improvement and consistency, allowing for research that is not limited by cow numbers at any one station. Several research projects focused on fescue toxicosis have been initiated as a result of the increased capacity across all of the stations dealing with beef cattle.

In 2015, the Bioenergy Research Initiative (BRI) initiated its third grant cycle by awarding \$1 million to 12 separate projects. Nine projects are with NCSU, two with Carolina Land & Lakes RC&D Council and one is with Appalachian State University. The portfolio of projects expanded beyond production of trees and perennial grasses to include using wood pellets for heat and developing a biomass/bioenergy roadmap.

The Research Stations continued to utilize a regional management approach that takes advantage of the diversity and “connectedness” of the system. The sharing of both labor and equipment resources is becoming the norm and a standard way of doing business. Efficiencies are gained and capability at individual stations is enhanced by pooling resources to accomplish the research mission.

During 2015, Research Stations hosted 474 agricultural research projects with 117 faculty at NC State, NC A&T, and USDA-ARS, utilizing 1,233 acres in small plots (not including land for pastures and forages). The Stations hosted over 15,000 registered visitors at 398 separate events such as field days, seminars, workshops, and other training 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 burgeoning population, food production will have to at least double over the next 35 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 invested in agricultural research in North Carolina to replace and upgrade an aging fleet of equipment and outfit stations 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 over two fiscal years.

During the two-year implementation, the Research Stations Division acquired \$7.79M of new equipment. This was done by leveraging the trade-in value of outdated equipment as well as some self-generated receipts. In total, 165 pieces of modern agricultural equipment were acquired for supporting agricultural research across North Carolina. These included tractors, planters, irrigation equipment, harvesters, utility vehicles, and other equipment.

A summary of the equipment upgrade over two fiscal years follows:

Total Legislative appropriation	\$5 million
Leveraged value of trade-in equipment	\$1.98 million
Additional self-generated receipts	\$910,000
Total value of new equipment acquired	\$7.79 million
Number of new equipment pieces acquired	165

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. The Research Stations Division continue to advance in the deployment of GPS-related technology and wireless connectivity. The advantages are many, but include greater precision in implementing research, increased efficiency for operations, and replicating production practices more similar to current agricultural practices in North Carolina. Research Station superintendents are finding creative ways to implement technology in all facets of the research program.

Enhancement of the Beef Cattle Research Resources in North Carolina: The system continues to develop a uniform herd of cattle to better support research programs in the animal and forage area by coordinating husbandry activities between all of the stations as prescribed in the 2013 plan. We are seeking to increase the capacity for researchers to compete nationally and have initiated several projects related to fescue toxicosis.

Embryo Transfer from the superior cattle at Upper Piedmont Research Station near Reidsville continues to be the primary method of establishing uniform genetics among all of the resident herds. Heifers

born at Mountain Research Station near Waynesville and Butner Beef Cattle Field Laboratory, which were ET calves themselves, are being bred to become future replacements for the current cross bred cow herd. The production

of these females will accelerate the establishment of a uniform set of cows.

Bovine genetic progress is slow; as the generational interval of cattle is more than four years. During this phase, the infrastructure within the system is being upgraded. Examples of improvements include fixed-knot fencing at multiple research stations, improved surface-water management, working facilities and enhanced utilization of forage resources across multiple stations. All locations are active participants in the CattleMax system that coordinates the tracking of cattle resources within the system.

While concrete progress toward the 2013 plan can be measured in both cattle genetics and infrastructure, the most notable changes can be observed in the interaction between the staff at these locations. The current system allows for the optimization of resources by allowing the staffs to work together for the common good of all locations. The team has found innovative ways of capturing the opportunities that exist because of the different environments within the system.

Training programs: While investing in equipment is important, our people are our greatest resources. Staff from all 18 research stations have taken part in professional development opportunities and will continue to do so. In 2015, four 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, Tobacco Workers Conference and the Beltwide Cotton Conference. Many serve on local and statewide boards. The Research Stations Division 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 has installed three new forest research projects and continues to host seven existing projects. The relationship with NCSU's College of Natural Resources continues to grow and we are optimistic that we will continue to increase forest research on division lands. Educational use of the Research Stations' forestland has increased and so far this year has included four faculty field tours, four class tours, the use of the Umstead Research Station by the senior capstone course in forest management at NCSU, and two undergraduate student research and work projects. Forest harvests have been within the planned allowable acreage limits to ensure sustainability. Harvested areas have been reforested to ensure continued stand improvement and the potential for future management. The Forest Management Program of the NCDA&CS Research Stations Division continues to accomplish its assigned objectives.

North Carolina Bioenergy Research Initiative: In 2015, the Bioenergy Research Initiative (BRI) initiated its third grant cycle by awarding \$1 M to 12 separate projects. Nine projects are with NCSU, two with Carolina Land & Lakes RC&D Council and one is with Appalachian State University. The portfolio of projects expanded beyond production of trees and perennial grasses to using wood pellets for heat and developing a biomass/bioenergy roadmap.

BRI hosted a field day at the Mountain Horticultural Crops Research Station in Henderson County with over 130 attendees representing land owners, academia from high school to researchers, and industry leaders. BRI conducted its first Research/ Industry Update meeting with 85 attendees.

BRI hosted Leadership Granville, offered support to start-up companies, and participated in several high school career days. One high school student volunteered weekly for on-the-job-training and extra-curricular experiences.



GOAL 2: ENSURE EFFICIENT RESEARCH STATION AND FARM MANAGEMENT



Research is conducted on over 80 commodities produced in North Carolina. We have one of the most diverse agricultural states in the nation, which is supported by research on our 18 research stations.

By the Numbers:

Research faculty at NC State, NC A&T, and USDA working on NC Research Stations	117
Research projects conducted across the system	474
Graduate students working on and receiving training on the research stations	153
Acres devoted to small-plot research (not including land for forages)	1,233
Field days, seminars, and other training and educational events	398
Number of attendees at field days, seminars, and other training and educational events	15,064

Regional Management: In 2015, the Research Stations continued to utilize a regional management approach that takes advantage of the diversity and connectedness of the system. The sharing of both labor and equipment resources is becoming the norm and a standard way of doing business. Efficiencies are gained, and capability at individual stations is enhanced, by pooling resources to accomplish the research mission.

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. Another example in cattle management is the specialization some staff have acquired in techniques such as embryo transfer which can be utilized on multiple stations in the beef program. Several stations no longer have office support, but rather share office support with other stations. Management has 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, inherent hazards. Recognizing these realities, as well as the high cost of worker's compensation claims, the Research Stations re-allocated two vacant positions into safety officer positions in December of 2013. The safety officers work as a team, with one covering Eastern North

Carolina and the other focused on the Western part of the state. 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 emphasis on safety has made our working environment one that is better for employees, and results in less lost time and worker's comp expenses. In 2015, the worker's comp cost from the Research Stations Division was reduced for the second year in a row. We continue to emphasize all aspects of safety, especially hazard avoidance. Each time an incident (injury or near-miss) occurs, a simple electronic notice is sent to all units within 24 hours. The sharing of information concerning hazards is critical to hazard recognition and avoidance.

Efficiency through technology: To a great extent, the success of research relies on good communication and accurate record-keeping. Research Station staff strive to have the best communication possible, with research project staff and maintain a myriad of records related to the projects, as well as routine safety inspections, inventories, and production records for each farm. Several pilot projects were initiated in 2015 to utilize wireless technology, cloud storage, tablets, and cell phones to streamline communication and record-keeping. These have proven to be beneficial, providing more readily accessible and efficient forms for implementing research projects and maintaining records and inventories. Further

implementation of modern technology to research project and farm management will continue in 2016.

An internal review of all research stations and field laboratories was started in 2015, with superintendents conducting a peer-review process, and a system-wide analysis of labor utilization. Additionally, campus faculty listening sessions were conducted to gain feedback from researchers about research stations efforts.

A large data project was sponsored by the Association of Public and Land-Grant Universities (APLU) and was entitled "A National Study of Capital & Deferred Maintenance at Schools of Agriculture". The Deferred Maintenance study required each off-campus location to identify buildings, type of structure, age of structure and any renovations. In total, 1,039 buildings / or structures on the off-campus locations were entered into the APLU data base.

GOAL 3: ENHANCE WORKING RELATIONSHIPS AND COMMUNICATION

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 2015. The role of the advisory committees is to further enhance communication between research faculty and 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, NCSU, 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 anchor research and field activities for organic farm practices. CEFS is also a springboard for statewide initiatives such as the "10% Campaign" aimed at increasing consumption of North Carolina 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 integrated pest-management programs. In 2015, the Research Stations Division hosted the Research Centers Administrators Society annual summer meeting. RCAS is the national organization for research farm managers. During the four-day meeting, around 100 colleagues from across the country were introduced to our research stations and agriculture in North Carolina, prompting a healthy exchange of information.





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:

“Although we utilize 15 to 20 acres of field space at several research stations annually, two of the most important sets of data we collect each year come from ‘out of the way’ tests of approximately 1.5 acres each at the Cunningham Research Station at Kinston.

The first is a specially irrigated and inoculated test of Fusarium Head Blight (Scab) resistance in wheat breeding lines and varieties in the N.C. Official Variety Test. Scab is the single biggest threat to the state’s wheat crop, so it is vital we collect data annually on the resistance levels of the varieties being grown here.

One of the best ways to breed wheat is to learn how to grow the crop properly, and then do everything slightly wrong. The second important test is a headache for station management because we ask them to disk up a corner of a no-tilled soybean field before it can be harvested. Then we plant wheat a month early in September!! In this test, we evaluate wheat varieties and breeding lines for resistance to Hessian fly, another major pest of N.C. wheat. The worst management practice one can follow, if you have a Hessian fly issue, is early planted wheat into a no-tilled soybean crop. We always get great data!” — Dr. Paul Murphy, Professor & Small Grain Breeder, NCSU

“Research stations have been invaluable in my work on weed management. In recent years, much of my work has been with transgenic crops under USDA-regulated status. The security offered on stations and the assurance that the crop will not be accidentally harvested and enter commercial channels has been essential for the work. Also, weed management research is dependent upon uniform and heavy weed infestations. Many of the stations maintain fields dedicated to weed research. There will be non-treated checks and plots with less-than-adequate control. This makes on-farm research difficult as most growers understandably do not want weeds in their fields. Station managers understand our needs and “tolerate” our weeds.” — Dr. Alan York, William Neal Reynolds Professor, Crop Science, NCSU



Mountain Horticultural Crops Research Station. Photo by Marc Hall.

“In terms of economic importance, the pig industry is the second largest agricultural commodity in North Carolina. Hence technology development is needed to sustain North Carolina pig farmers and uplift our rural communities. The partnership between NCDA research stations and NC State scientists provides a competitive advantage for North Carolina pig farmers. Research projects conducted through this collaborative effort develop near- and long-term solutions that enhance farmer profitability. Studies conducted at the NCDA Tidewater Research Station are essential to my research program. This collaborative effort allows me to address the immediate- and long-term technology needs of North Carolina pig farmers, train future scientists and leverage outside funding.” — Dr. Mark Knauer, Assistant Professor & Extension Specialist, Animal Science, NCSU

“Research stations have been and continue to be critical to the success of NC State’s agricultural research programs and our decades-long partnership has been extremely productive. Virtually all of the new varieties, and the cultural management programs developed for them, have at some point been tested on one or more of NCDA&CS’ research stations prior to on-farm testing. NC’s farmers have benefited greatly from this work, and I think if you asked any farmer in NC about this, they would certainly agree.” — Dr. Craig Yencho, Professor & Sweet Potato Breeder, NCSU

GOAL 4: STRENGTHEN OUTREACH, EXTENSION AND EDUCATION

Field Days

- Research Stations hosted 398 field days, seminars and trainings focused on beef, soybeans, small grains, peanuts, tobacco, blueberries, turfgrass, vegetables, tree fruits, and other commodities.
- In 2015, stations participated heavily in a new pollinator habitat area pilot project with private support. Recognizing the value of pollinators across the landscape, all 18 stations established pollinator habitat plots to provide host plants for the myriad of pollinators present in North Carolina. Each was appropriately signed and served a dual function of increasing pollinator habitat and increasing public awareness. In 2016, plans are to expand and monitor these plots with NC State faculty to assess the status of pollinators on our research stations and the impact of increased habitat area.
- Partnerships with Cooperative Extension and Research Stations continued to strengthen in 2015. 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 specialists 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.
- Visitors to the Research Stations in 2015 were able to ride in trams, or people movers, purchased in 2013 and 2014, 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 visitors to enjoy events on the Research Stations. The trams are in high demand and are frequently moved around the state for our events.

Ag and Science Teachers

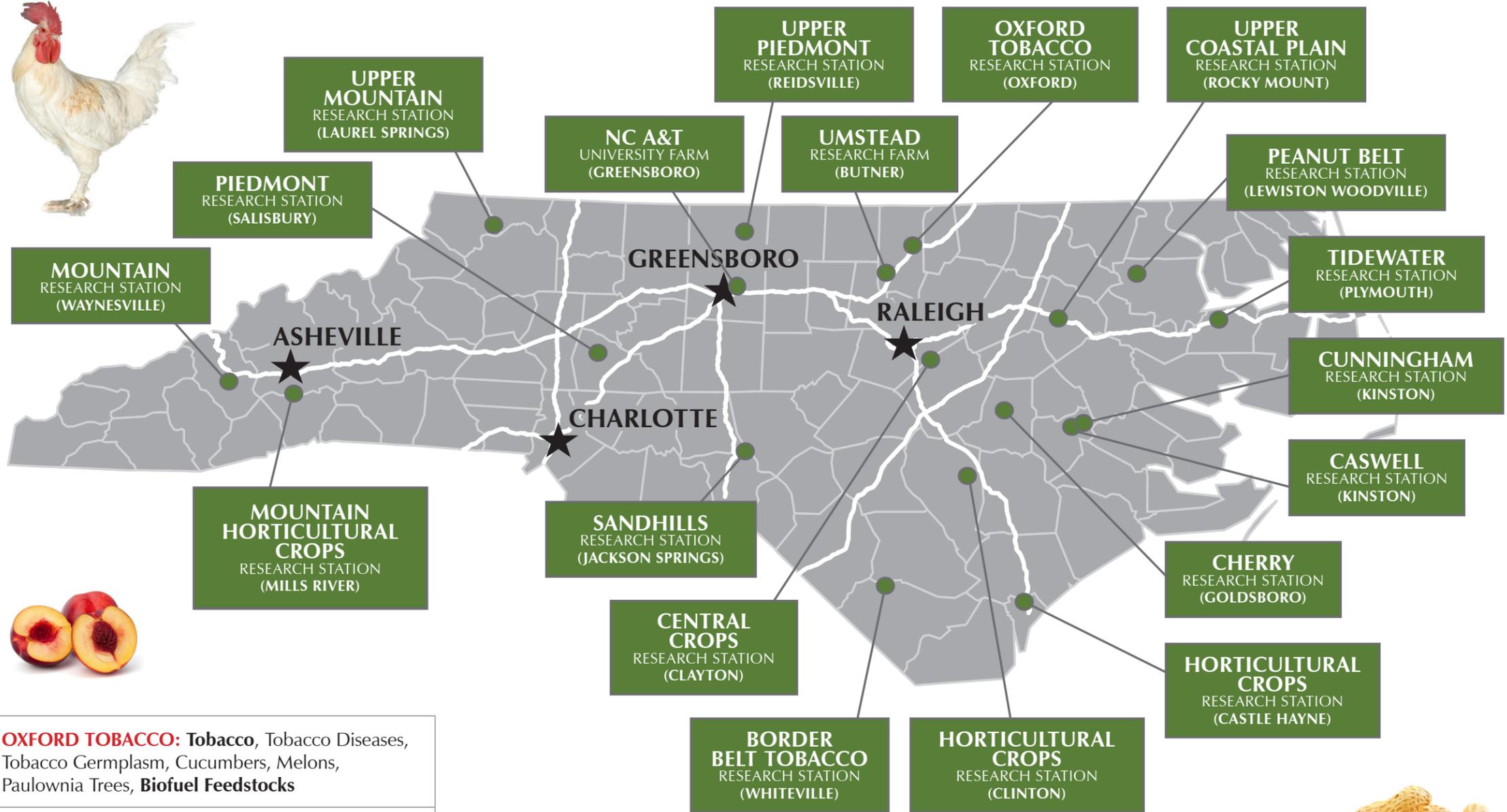
- Central Crops Research Station is working with a teacher and student from Clayton High School to collect 14 soil monoliths, which will be preserved and utilized for future soils classes.
- The Northeast Region Biotechnology/Agriscience High School completed its third year. After being temporarily located in the Vernon James Center located at the Tidewater Research Station, the school relocated to nearby Jamesville. Students continued to be frequent visitors to the Tidewater Research Station and worked on numerous projects at that site with Research Station staff and faculty from NCSU.
- The Mountain Research Station in Waynesville worked with Haywood County schools and Cooperative Extension’s 4-H program to host youth shooting sports workshops and activities.

NORTH CAROLINA RESEARCH STATIONS

* Items in bold are primary reasearch interests



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



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

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





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