

## BIOTECHNOLOGY WORKS IN NORTH CAROLINA

AN OVERVIEW OF THE BIOTECHNOLOGY CENTER'S REPORT

# Agricultural Biotechnology Takes Root Statewide

**A**griculture has shaped North Carolina.

Generations of Tar Heel farmers have tilled the soils of the sandhills and coastal plains to bring forth the cotton that has kept their neighbors employed in gins and textile mills.

Families have pressed tobacco seedlings into small fields of red Piedmont clay for centuries and, with luck and patience, converted the resulting Bright leaves into greenbacks — a comfortable life from land too paltry for most other crops.

Folk healers responding to nature, need and Native American wisdom have coaxed medicinal secrets from indigenous plants lifted from Appalachian mountainsides for eons.

From Murphy to Manteo, about one in every five North Carolinians works in a job related to agriculture, plant and animal. Agriculture contributes \$59 billion a year to the state's economy — one-fifth of its income. And even though markets have changed and challenges have emerged with each generation, Tar Heels have adapted their agricultural practices to survive — and thrive.

During the 1980s those adaptations started taking a decidedly scientific turn, as the potential value of biotechnology began to become obvious. North Carolina was especially well positioned to take advantage of this industry's expanding array of tools to coax living cells and biological molecules into useful products.

A statewide array of major public and private research universities,

community colleges, biotechnology companies and government leaders put these tools into place. The General Assembly established the North Carolina Biotechnology Center, the world's first, to make sure that the state's biotechnology tools would always get the necessary lubrication and maintenance.

The Biotechnology Center awarded more than \$10 million in ag-related grants and loans from 1984 to 2004 alone and also develops job training

— soybeans, corn, cotton, papaya, squash and canola — resulted in 4 billion additional pounds of harvest nationwide without the use of additional acreage. That translated into a \$1.5 billion improvement in farm income and a 46-million-pound reduction in pesticide use.

North Carolina is home to more than 30 agricultural biotechnology-related companies, making it one of the nation's top two states in the industry segment. These companies

---

***Applying the tools of biotechnology to just six crops — soybeans, corn, cotton, papaya, squash and canola — resulted in 4 billion additional pounds of harvest nationwide without the use of additional acreage.***

— National Center for Food and Agricultural Policy

---

and educational programs and supports efforts throughout the state to create, maintain and add to the commercialization of biotechnology. To help address biotechnology needs statewide, it has opened Southeastern, Eastern, Piedmont Triad and Western regional offices, and plans to open a fifth in the spring of 2006 to serve greater Charlotte.

North Carolina is a world leader in recognizing biotechnology as a tool whose power exceeds that of plows and planters. Its scientists have used their ever-growing understanding of genetics and related systems to design new crops, improve others and find new uses for traditional agricultural products and wastes. A 2002 study by the National Center for Food and Agricultural Policy reported that applying the tools of biotechnology to just six crops

employ more than 2,500 people in a wide range of ag-related endeavors. A few examples include:

- **HERBICIDE RESISTANCE** Researchers have genetically modified cotton, soybeans and other crops to withstand herbicide. That has allowed farmers like Beaufort County's Milton Prince to compete in the global arena, growing cotton more efficiently while minimizing negative environmental effects.
- **DROUGHT RESISTANCE** Researchers at Durham's Sun Dance Genetics and Duke University have genetically modified corn to help it resist drought conditions that have plagued North Carolina — especially during the past decade. Similar efforts at drought resistance in various plants used for food and fiber offer hope for

avoiding famine in many developing nations.

- **BIOFUELS** Golden LEAF, the foundation that invests the state's money from the national tobacco settlement, has put \$10 million into a \$45 million biodiesel plant that is to employ about 100 eastern North Carolina residents converting locally grown soybeans into biodiesel. It's expected to convert some 9 million bushels of soybeans a year into 10 million to 12 million gallons of the alternative fuel. As the nation's leader in sweet potato production, North Carolina also stands to gain from researchers' efforts to find ways to extract ethanol from the tuber. Meanwhile, companies such as Novozymes, the world's largest producer of industrial enzymes whose North American headquarters is in Franklinton, are exploring ways to make ethanol production more efficient through biotechnology. Fuel from corn, corn stalks, switchgrass, wood waste and other plant fiber will play an increasingly important role in America's energy independence — and North Carolina is a leader, with state tax incentives for producers and users of biofuels already in place.
- **GENOMICS** Syngenta corporate scientists are mapping the watermelon genome — the “table of contents” listing all the genes that define an organism. It's not just a scientific curiosity. It's one of many genome-mapping projects taking place worldwide to help researchers find genetic variations that might signal desirable — or undesirable — traits. Others have already targeted the human genome. But in North Carolina, more acreage is devoted to watermelon production than to any other vegetable. Understanding its genome can help scientists splice in genetic traits for disease resistance and other beneficial characteristics.

- **FORESTRY** North Carolina's world-renowned Christmas trees often adorn the White House. But the balsam woolly adelgid (*Adelges piceae*), a pest that attacks Fraser firs, threatens the \$100 million-a-year industry. Researchers are using the tools of biotechnology to speed up nature's own tricks of species preservation to develop trees that thwart pests — and trees that grow faster and produce desired wood characteristics.
- **AQUACULTURE** Plants and animals that live in fresh and salt water are commercially important to North Carolina. Biotechnologists are exploring new ways to diagnose and prevent diseases affecting fish and other water-dependent species. Even the lowly water-growing “duckweed,” or lemna, has been transformed into a miniature green pharmaceutical factory by a 10-year-old Pittsboro biotechnology spinoff from N.C. State University research — Biolix. The fast-growing lemna has shown promise as a cellular “greenhouse” for growing everything from enzymes useful in hog-waste removal to an improved interferon for treating hepatitis C.
- **NATURAL PRODUCTS** North Carolina's mountains are home to many herbs and other natural products that have been gathered for generations and used as medicines. The powerful scope of biotechnology is increasingly permitting scientists to understand those medicinal properties — and to open the door to badly needed jobs in their commercial applications.
- **POULTRY** Scientists at N.C. State University have developed an enzyme — a protein-dissolving protease — that shows promise for increasing the efficiency of chickens' digestion, producing more meat per pound of feed. They formed a company, BioResource International, to develop the feed

additive into a commercial product predicted to be worth \$200 million a year globally.

Biotechnology raises important questions as its potential unfolds. Regulatory agencies and other organizations work to maintain socially, economically and environmentally sustainable outcomes from new discoveries. But agricultural biotechnology, like many new things, faces hurdles. For example, Japan and the European Union have resisted the importation of foods grown with the help of biotechnology in the United States, even though these products must undergo a nine-step U.S. regulatory process. Other nations embrace it, however, because it may offer the most feasible alternative for improving access to food and fiber.

Recognizing North Carolina also faces rising competition from some 40 other states hot on the Tar Heels' embrace of biotechnology, the Biotechnology Center in 2004 released *New Jobs Across North Carolina: A Strategic Plan for Growing the Economy Statewide through Biotechnology*. The plan, developed at the request of Gov. Mike Easley and guided by a blue-ribbon committee chaired by former governors Jim Hunt and Jim Martin, offers 54 strategic recommendations for growing the state's biotechnology industry and creating jobs. And many of those jobs will have salaries and opportunities normally associated with science, but with their roots in agricultural biotechnology.

*Agricultural Biotechnology Takes Root Statewide, the agricultural biotechnology document from which this “BioBrief” was excerpted, and other information about biotechnology in North Carolina are on the Biotechnology Center's Web site at [www.ncbiotech.org](http://www.ncbiotech.org). CONTACT: Jim Shamp, News & Publications Editor, (919) 541-9366 or [jim\\_shamp@ncbiotech.org](mailto:jim_shamp@ncbiotech.org)*