Agricultural Research Service

ARS is the primary in-house research agency in USDA. It conducts a balanced program of fundamental and applied research that concentrates on problems that are national or regional in scope.

The agency maintains a network of geographically dispersed national and overseas laboratories, allowing USDA to:

- Perform long-term, high-risk research,
- Respond to both stable and changing technical goals,
- Ensure research accountability, and
- Form, disband, or coordinate interdisciplinary research teams (often at different sites) from a large, diverse scientific work force.

Areas of research emphasis for ARS correspond to high-priority problems identified by scientists, internal program evaluations, users, new legislation, appropriations, action and regulatory agencies, and executive branch initiatives. Major areas of research are described in the following sections.

Soil, air, and water

ARS is focusing on the increasing critical issues of environmental degradation. Currently, the Agency is working on:

- Improved production systems that will protect water quality from the effects of agricultural chemicals and control erosion when crop residues are low,
- Strategies for off-site control of chemical buildup in ground water,
- Methods for assessing the possible effects of global climate change on water and energy fluxes, water resources, and the health and sustainability of agroecosystems,
- Ways to facilitate conservation tillage, and
- Evaluating and optimizing no-till and other conservation tillage and residue management systems—to increase soil organic matter, infiltration, and soil biological activity and to reduce runoff, erosion, evaporation, and drought damage.

Plant Productivity

ARS focuses on the traditional concern of enhancing plant yields, including such projects as:

- Enhancing plant germplasm by manipulating genomes at the molecular level and improving plant genetic resources to overcome productivity barriers in major crops,

- Technologies for controlling fundamental biological processes relating to productivity, market quality, and production costs,
- Long- and short-term acquisition and preservation of plant germplasm,
- Detection at the molecular level of pathogens in propagative material,
- Methods for nondestructive testing of seed viability and composition and for environmentally safe pest control with acceptable health risk,
- Management systems for sound ecosystem maintenance and water use on important range, pasture, and crop lands,
- Weed and plant disease control,
- Areawide control of high-priority pests,
- Development of a relational database for the national plant germplasm system, and
- Computer simulation models for growth and development of economically important crops and weeds.

Animal Productivity

ARS projects to increase animal productivity seek ways to:

- Reduce mortality and other losses from disease and parasites,
- Improve genetic resistance to diseases and parasites,
- Use biologically based control of parasites,
- Control zoonotic bacteria and parasites in live animals,
- Increase the genetic capacity of animals for greater production,
- Evaluate behavioral, physiological, and productivity indicators of animal well-being,
- Understand the physiological processes involved in feed intake and metabolism and mechanisms by which chemical and physical composition of feed can limit nutrient availability,
- Make nondestructive repeated measurements of body composition, and
- Use animal wastes and means to reduce waste contamination of surface and ground water.

Commodity Conversion and Delivery

In efforts to improve the processing of agricultural commodities, ARS is seeking:

- Means to prevent or eliminate foodborne microorganisms in animal products, prevent mycotoxins in food and feed products, eliminate insect and disease trade barriers limiting agricultural exports, meet marketing requirements (including physical, sanitary, performance qualities) for various commodities, and extend shelf life with sensory quality retention,
- Methods for rapid, objective analysis of marketing safety and quality characteristics,
- Technologies for converting agricultural commodities to value-added industrial products; alternative fuels; and new fiber, leather, feed, and food products,
- Process treatments to enhance food safety, minimize residues or additives, and retain quality, and
- Alternative processing methods that are environmentally benign.

Human Nutrition and Well-Being

Research in this area seeks:

- Methods to determine composition of commonly consumed foods and to change food production and processing systems to improve the nutritional quality of food,
- Better understanding of the role of dietary components in weight maintenance and risk of chronic diseases,
- Identification of adequate and safe ranges of nutrient and calorie intake,
- Explanation of the molecular and cellular basis of human nutrition,
- An ongoing national data bank on the nutrient content of foods, and
- Monitoring the food consumption of the U.S. population.

Reaping the Products of Research

While much ARS research lays the foundation for long-term development, the ultimate beneficiaries of this research are the Nation's consumers. Each year, dozens of new products and improved varieties of fruits, nuts, and vegetables emerge from ARS laboratories and greenhouses. Here's just a sampling:

***Potatoes.** Americans eat an average of more than 100 pounds of potatoes each year, about half from fresh potatoes and half in processed foods. Research has brought forth a slew of new, improved potato varieties for both uses. For example, Atlantic makes potato chips with lower fat content than any other variety, thanks to its low ratio of water to solids. Atlantic is now the Nation's number one chipping potato.*

***Wheat.** For 50 years, ARS laboratories have worked with all segments of the baking industry to help provide consumers with uniform, flavorful, nutritious bread and other wheat products. Throughout the country, ARS scientists who work with wheat aim to make U.S.-grown grain better all the time. It's not an easy job. Techniques for successfully slipping new genes into crops like tomatoes or petunias typically don't work on wheat. After years of effort, scientists have won many victories.*

A yardstick for their wheat-breeding success is the popularity of the new varieties they've come up with. One variety alone accounts for most of the soft red winter wheat that's grown in the Eastern United States. Why? Because it stands up to wheat's most destructive disease, leaf rust. Other varieties have amazed even dubious wheat farmers by resisting the Hessian fly and cereal leaf beetle, two costly insect pests.

***Milk.** If you're among the many American adults who have trouble digesting lactose, you may already know about the lactose-free dairy products that ARS scientists developed by altering a bacterium*

used to make cheese and yogurt. It produces an enzyme that in turn breaks down the milk's lactose, sparing you an upset stomach.

Peaches. *A laboratory technique called embryo culture has proven especially helpful in creating new peach varieties. When nurtured in petri dishes, tiny embryos that could not survive in nature are cultivated into plantlets. Tended carefully in the greenhouse, the plantlets can eventually be planted outdoors in the research orchard.*

Turkeys. *Rearing turkeys has become a lot easier for producers, thanks to ARS innovation. The Beltsville Poultry Semen Extender enables poultry producers to set up "turkey stud farms" with only the best males, thus making the most efficient use of artificial insemination.*

Citrus Fruit. *In Florida, ARS has come up with citrus varieties that have higher yields, increased disease resistance, better color, and longer shelf life. For example, juice from cold-hardy Ambersweet is fresh and approved for use in orange juice products. Because it withstands Florida's occasional cold snaps that can ruin most citrus, Ambersweet is being widely planted in the Sunshine State. It took 20 years of patient breeding to develop it, but the payoff is huge.*

Rice. *Rice, a billion-dollar annual crop, is grown in only six States: Arkansas, California, Louisiana, Texas, Mississippi, and Missouri. Long-grain, an American favorite, is raised chiefly in the South, while medium and short-grain rice grows mainly in California. And everywhere that rice is grown, ARS research stands behind the crop.*

Much of this work involves breeding better rice. In 1993, a single ARS-developed semidwarf rice variety, Lemont, covered 600,000 acres. That same year, its cousin Gulfmont contributed another 147,000 acres. Together they accounted for nearly 30 percent of the rice in four States. Semidwarf varieties have short, stout stems, so they don't fall over in a strong wind or rain, and their grain-laden heads do not snap off before the rice can be harvested.

Catfish. *Catfish, long regarded in the South as a down-home delicacy, was hard to find in supermarkets elsewhere until recently. But now, thanks to aquaculture, pond-raised catfish is a popular item in the frozen food case. ARS helped increase fish farming by breeding fish for disease resistance, finding better feed, and eliminating chemicals that contribute to off flavors.*

SuperSlurper. *When ARS scientists married starch to a synthetic chemical, they managed to create a product so thirsty it could absorb hundreds of times its own weight in water. Someone called it SuperSlurper, and the name stuck. After patents were secured in 1976, SuperSlurper started popping up all over the marketplace.*

This absorbent compound, which can slurp up to 2,000 times its weight in water, is used as an electrical conductor in batteries; it is

found in fuel filters, baby powders, and wound dressings; and compounds very much like it are used in disposable diapers and sanitary napkins.

Poinsettia. *Not only is poinsettia the most popular Christmas plant, it is the number-one flowering potted plant in the United States, even though its traditional sales period is just 6 weeks. That was not the case back in 1976, when ARS first began its program to improve the flower's dependability. This meant discovering the exact conditions of light and temperature the plant requires. Researchers also performed breeding experiments that defined how color develops, and they devised precision growing methods that enabled massive cultivation. Last year, the wholesale value of the poinsettia crop reached nearly $170 million—a jump of more than 400 percent since 1976.*

Cotton. *When medics during World War II pleaded for self-clinging elastic bandages, stretch cottons were born. After the war, consumers asked ARS to make stretch cotton available in diapers, socks, and underwear, so ARS chemists invented three different ways to put more stretch into cotton.*

Next, ARS helped unchain Americans from the ironing board. First, scientists brought forth the first wash-and-wear cotton shirts. Then they improved the process by which durable-press cotton fabric finish was created so it would pose no health risk to textile workers. A new way to cross-link cotton fibers used citric acid to do the trick. The improved process, which has been patented, keeps cotton fabrics wrinkle-free for more than 100 washings.