its creation, ARS has provided continuity for all USDA research.

For example, ARS's nutrition research is a direct descendant of the work of Wilbur O. Atwater, USDA's first chief of nutrition investigation, who is widely regarded as the father of modern nutrition research and education. Just over 100 years ago, Atwater made the first modern food composition analysis in the United States. His work was the beginning of the program which ARS maintains today as the USDA National Nutrient Database for Standard Reference.

Another example of how ARS carries on the historic work of USDA is the dairy herd improvement program, started by USDA in 1910 and still run by ARS today. The program began keeping detailed records of milk output and other characteristics used to decide breeding choices. During the first 10 years, this led to an average yearly milk production per cow increase from 5,354 to 6,637 pounds. Today, total milk production of cows has increased more than four-fold from this program, specifically tripling in the last 50 years.

Crops and Plants

One of USDA's oldest ongoing programs—plant germplasm exploration, preservation, and distribution—is continued today in ARS as the National Plant Germplasm System (NPGS).

Plant exploration and collection from all over the world are essential for agriculture because crops must be continually enhanced to overcome diseases and pests, expand drought and temperature tolerance, adapt plants to new growing conditions, and make them more productive, nutritious, and durable—or simply better tasting. Also, agricultural plant biodiversity is eroding as growth in global human population forces shifts in land uses and more displacement of indigenous crops.

Roots of ARS's current germplasm collecting go back to the likes of USDA plant collector Frank Meyer, who has had a remarkable impact on U.S. agriculture. From 1905 to 1918, he brought back samples of plants from apples to zoysia grass. One of Meyer's most significant contributions was soybeans. Before he went to China in 1905, only eight varieties of soybeans were grown in the United States, mostly for animal forage. By 1908, Meyer had added 42 new soybeans, which have parented thousands of varieties over the years. Among the soybeans he collected was the one that gave rise to U.S. soybean oil production, an industry worth billions of dollars today.

Tracking the effect of what Meyer and other USDA explorers have brought back over the years is hard, because decades can pass before collected plants may be bred into a new variety.

USDA plant explorer Frank N. Meyer, pictured here following a plant collection trip in the mountains of China in 1908, was an early luminary who brought back plants from apples to zoysia grass.

Exotic items like these unusual maize specimens from Latin America are preserved in the ARS National Plant Germplasm System because they might have genes to help solve future problems.

For example, the zoysia grass that Meyer collected in the early years of the century did not evolve into a commercial variety until 1951.

Today, NPGS is ARS's responsibility and a vital world resource. It consists of the National Center for Genetic Resources Preservation (NCGRP), in Fort Collins, Colorado, two dozen ARS-operated repositories located across the country, and the Germplasm Resources Information Network (GRIN), the database system that collects and makes available information on genetic resources. This ARS-developed system has enabled sharing of germplasm information around the world.

"Before the advent of the NPGS, collections basically belonged to individual researchers and depended on whether and how they kept records and on what they had collected."

explains NCGRP director Henry Shands. "Things were managed for the individual research programs, which wasn't a problem for the success of those research programs. But it didn't leave information and plants especially accessible for others to use."

In addition to the data in GRIN, ARS sends out more than 100,000 germplasm samples each year to researchers in many countries. The program also trains foreign scientists and technicians in germplasm preservation as part of its exchanges with other countries and even acts as a backup storage depot for germplasm collections of countries that fear catastrophic losses.

Filling the Cornucopia

Of course, ARS itself has also put germplasm to work, producing crop varieties that have served critical needs for agriculture.

Almost all of the blueberries and cranberries in commercial production were either developed by ARS or bred from ARS varieties.

Take B73 corn, a result of a joint ARS and Iowa State University research program in the 1970s and 1980s. B73 remains the basis for virtually all the seed-parent lines of corn throughout the United States and much of the rest of the world. In 1990, it was found that the lines from this program were so widely used that they had made their way into most commercial corn produced in the U.S. Cornbelt. These lines produce an estimated $1 billion per year for the American farmer. In part because of such improved breeding lines, average U.S. corn yields in the past 40 years have more than doubled.

So widespread are ARS's plant improvements that consumers are very likely to be buying a product of ARS research any time they shop for produce. New flavors, extended harvest seasons, increased growing range, and better shelf life are just a few of the improvements ARS researchers have made.

Almost all blueberries and cranberries in commercial production were either developed by ARS or bred from ARS varieties. ARS also brought consumers supersweet strawberry varieties with longer shelf life. Southern-grown fresh peaches would probably not be readily available to consumers in eastern U.S. markets if ARS had not developed improved peach varieties as well as the Guardian rootstock.

More ARS Crop Improvements

More than half the rice grown in the United States comes from USDA-developed varieties. The high quality of this rice is one of the reasons that 1 of every 5 bushels of rice on the world market is grown by U.S. farmers. USDA has also developed rice-growing practices that use fewer herbicides and other chemicals.

The Roma tomato was released by ARS in 1955, and it is still the main variety used for tomato paste.

ARS released the Atlantic potato in 1976. It's still the most popular chipping potato.

Since ARS developed the soybean computer model and decisionmaking software GLYCIM, it has given soybean growers an increase in yield of up to 29 percent and boosted irrigation efficiency up to 400 percent.

A system of crop cultural and control methods put together by ARS has helped lead to the near eradication of the boll weevil, a bug that once wiped out cotton growing in many southern states.

ARS developed a test kit that detects 55 different polyviruses of vegetables and flowers. The test kit is now sold in more than 90 countries and is considered the industry standard around the world.