

History of Research at the U.S. Department of Agriculture and Agricultural Research Service

Brown = USDA research accomplishment

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1833

Hog cholera first reported in the U.S. ([more information](#))

1843

Contagious bovine pleuropneumonia first introduced into the U.S.

1860

Farmers made up 58 percent of the labor force.

1861

Civil War began.

Proved that *Phytophthora infestans* caused Irish potato famine.

1862

USDA created.

Morrill Land-Grant College Act authorized public land grants for colleges to teach agriculture and mechanic arts. ([more information](#))

First man-made plastic invented.

First USDA research bulletin issued, on sugar content of several varieties of grapes and their suitability for wine.

Homestead Act passed.

Library of the USDA established.

1863

First monthly crop report published by USDA.

Dry farming, as type of commercial agriculture, began in Utah.

1864

Pasteurization invented.

Deficiency Act provided first statutory provision for employment of women.

1865

Slavery abolished by 13th amendment to the Constitution.

1866

Gregor Mendel showed that traits pass from parents to offspring, the foundation of modern genetics.

1867

Patrons of Husbandry, later known as the [National Grange](#), organized by USDA employee. This was the first general farmers organization to permit women equality of membership and privilege.

First patent issued for barbed-wire fencing.

1868

Division of Botany created to preserve herbarium material collected in government expeditions. [\(more information\)](#)

Refrigerator railroad car patented.

USDA began research on animal diseases. [\(more\)](#)

1869

First transcontinental railroad completed.

Gypsy moth accidentally brought into the U.S. from France; established in Medford, MA. [\(more\)](#)

Suez Canal opened.

First practical spring-toothed harrow patented; eliminated breaking teeth on roots and stones.

Dmitry Mendeleev published the organizational groundwork for the periodic table of elements.

First analysis of food published in the U.S., for corn. [\(more information\)](#)

1870

Of gainfully employed persons, 47.4 percent were engaged in agriculture. This was the first time that farmers were a minority.

Foot-and-mouth disease first reported in the U.S. [\(more information\)](#)

Developed a middling purifier with a roller process for grinding to produce superior flour.

First systematized, synchronous meteorological report ever taken in the U.S. was read and transmitted by telegraph.

1871

Illinois Warehouse Act regulated grain elevators.

Patent for cotton stripper granted.

1872

Burbank potato produced, followed by many improved vegetables, fruits, and flowers.

1873

Grasshoppers became a serious pest in the West.

The Washington navel orange introduced into California with trees secured from Brazil by USDA. ([more information](#))

Aberdeen-Angus bulls imported from Scotland.

1874

Mennonites make first important introductions of wheat from Turkey into Kansas.

Pressure cooker invented; patents first granted in 1902, but not in general use until 1935.

Glidden barbed-wire patent granted.

Manufacture of oleomargarine began in the U.S.

Durra sorghum, known as Egyptian corn, introduced into California from Egypt. ([more information](#))

Mechanical refrigeration invented.

1875

First state agricultural experiment station established at Wesleyan University, Middletown, CT.

First commercial feed mill established.

1876

Telephone patented by Alexander Graham Bell.

Germ theory of disease verified.

Charles Darwin wrote the first complete analysis and description of hybrid vigor called *Cross- and Self-Fertilization in the Vegetable Kingdom*.

1877

Desert Land Act encouraged development of irrigation in arid lands; offered land at 25 cents per acre if irrigated and cultivated for 3 years.

United States Entomological Commission established to study grasshoppers.

British traders sent seed of the rubber tree (*Hevea brasiliensis*) from Brazil to Malaya; began Asian dominance of rubber market.

1878

Milking machine invented.

Sugar beets cultivated successfully in Maine under a system of vertical integration.

An all-roller mill constructed in Philadelphia led the way to more efficient, cheaper, and cleaner milling.

1879

First successful beet sugar factory in the U.S. built in California.

Formalized veterinary education began at Iowa State College, making it the oldest state veterinary college.

1880

One farmer out of every four was a tenant farmer.

Of gainfully employed persons, 49 percent were engaged in agriculture.

Evaporated milk developed.

1881

Two varieties of corn crossed by detasselling one of them, hybridizing the corn for the sole purpose of using the vigor of the first-generation hybrid to increase production. ([more information](#))

1882

Modern cream separator invented.

Tubercle bacillus isolated by German bacteriologist. **USDA scientist one of the first to chemically analyze it.**

1883

Methods developed to detect food adulteration, precursor to Pure Food and Drug Act. ([more information](#))

1884

First Federal animal quarantine law enacted.

Bureau of Animal Industry established.

1885

First fungicide invented from lime and copper sulphate, known as the Bordeaux mixture.

1886

Injected killed, whole-cell vaccine of hog cholera into pigeons to demonstrate immunity to subsequent administration of a live microbial culture. ([more information](#))

1887

Hatch Experiment Station Act provided Federal grants to states for agricultural experimentation.

1888

Office of Experiment Stations established.

Refrigerated boxcars made first long-haul shipments of produce and meat.

Vedalia beetles imported from Australia to control fluted scale on citrus, the first successful biological control program of a crop pest. ([more information](#))

1889

Department of Agriculture given cabinet status.

Controlled cottony cushion scale on citrus in California using biological control. ([more information](#))

1890

Sherman Antitrust Act passed.

Developed simple test to determine butterfat content of milk.

McKinley Tariff Act passed with a tariff on some agricultural products.

The second Morrill Land-Grant College Act authorized separate land-grant colleges for Negroes—17 was established. ([more information](#))

Meat Inspection Act authorized inspection of salted pork, bacon, and live animals intended for export, and the quarantine of imported animals.

Of gainfully employed persons, 43 percent were engaged in agriculture.

Combination corn-shucking and fodder-shredding machine patented.

Nitrifying bacteria isolated from soil.

1891

First comprehensive list of animal and human parasites developed; today it comprises more than 30 volumes.

Bacteria shown to cause plant diseases, including tumors.

Antibodies proposed as responsible for immunity.

1892

First successful gasoline engine farm tractor built by John Froelich.

Viruses discovered.

Contagious bovine pleuropneumonia eradicated.

Cotton boll weevil found near Brownville, TX. ([more information](#))

Canadian Marquis, first successful cross-bred spring wheat, released.

1893

Cause of cattle tick fever discovered; demonstrated that a disease-producing microorganism could be transmitted by an arthropod from one animal to another. ([more information](#))

1894

Carey Land Grant Act granted land to western states after irrigation provided by the states.

Milestone document in soil conservation published: Farmer's Bulletin No. 20, *Washed Soils: How to Prevent and Reclaim Them*. ([more information](#))

1895

Spindle-type cotton picker invented

Insects shown to spread plant diseases.

1896

First extensive table of food values published. ([more information](#))

1897

Tea Importation Act passed, the first U.S. law regulating food products.

Concluded that disease could be caused by depriving body of certain substances, later defined as vitamins. ([more information](#))

1898

Congress authorized testing of seeds purchased on open market.

First funds officially appropriated to collect, test, and prepare foreign plant materials. ([more information](#))

1890

Field mapping of soils began by USDA. ([more information](#))

1900

Work projects for farm youth organized; the name '4-H' adopted in 1913.

Lacey Act prohibited importation of injurious animals, birds, and fish.

Of gainfully employed persons, 38 percent were engaged in agriculture.

Mendel's work on heredity rediscovered.

1901

Bureau of Plant Industry established.

Complement fixation test developed.

Began experiments with Egyptian long-staple cotton.

1902

First plants methodically bred for disease resistance.

Reclamation Act passed.

Oily flavor in butter eliminated by pasteurization.

Dutch botanist, Hugo De Vries, announced his theory of mutation.

Pseudorabies of pigs–Aujeszky's disease–described and causative virus identified.

Existence and function of hormones discovered.

Sea Island, first wilt-resistant cotton released.

1903

Demonstrated that a virus causes hog cholera and that recovering hogs are immune for life. ([more information](#))

Wright Brothers demonstrated the first airplane.

1904

Date palm introduced to the U.S. ([more information](#))

1905

Insect Pest Act prohibited importation or mailing of live, injurious insects. ([more information](#))

Livestock Quarantine Act passed.

1906

Pure Food and Drug Act passed. ([more information](#))

Demonstrated that alkali soils could be reclaimed by flooding. ([more information](#))

Developed live-virus vaccine for hog cholera. ([more information](#))

28-hour law required humane care of livestock in interstate shipment.

Meat Inspection Act passed.

First caterpillar tractor powered by gasoline engine produced by Holt Company.

American and European foulbrood diseases of bees differentiated.

Mediterranean fruit fly introduced to Hawaiian Islands. ([more information](#))

Branding ink for use in meat inspection developed.

Founded the science of nematology in the U.S.

1908

Yuma released; first U.S. variety of long-staple cotton, followed by Pima in 1910.

1910

Wild blueberry domesticated.

Demonstrated that pasteurization kills toxin-producing organisms in raw milk without destroying beneficial lactic acid bacteria.

Insecticide and Fungicide Act passed.

Brucella abortus first isolated from cattle in the U.S.

Of gainfully employed persons, 31 percent were engaged in agriculture.

Demonstrated that typhus fever is transmitted by lice.

Radium isolated.

Cossack alfalfa released.

1911

First Farm Bureau formed in Broome County, NY.

Discovered a virus that can cause cancer in chickens, first experimental proof of an infectious agent of cancer.

Rubel highbush blueberry selected in the wild.

1912

Plant Quarantine Act passed.

Radioisotope labeling invented.

Seed Importation Act prohibited entry into the U.S. of certain adulterated grains and seeds unfit for seeding purposes.

Federal Plant Quarantine Act passed.

Thomas Hunt Morgan announced his theory of genes; began using the term 'gene' in 1904 to describe individual parts of chromosomes that control particular characteristics. ([more information](#))

USDA makes initial crosses between Lincoln and Rambouillet sheep breeds, leading to the Columbia breed.

Demonstrated that drought begins when soil moisture is so diminished that vegetation is unable to absorb water from the soil rapidly enough to replace the water lost to the air by transpiration.

1913

Virus-Serum Toxin Act passed.

Forerunner of the light tractor introduced.

Rhizobium nodules from soybean plants started world's first rhizobium collection; established as a formal collection in 1975. ([more information](#))

First U.S. veterinary license issued for production of anti-hog-cholera serum. ([more information](#))

1914

World War I began in Europe.

Smith-Lever Act formalized cooperative agricultural extension work.

Cultures of nitrogen-fixing bacteria supplied to legume growers for the purpose of increasing the plants' nitrogen-fixing capacity.

1915

Discovered bacteriophage.

Two publications reporting research on terraces and control of gullies printed. They remain the standard reference works in their field for erosion control. ([more information](#))

Studies made of precooling to prevent decay in red raspberries; these studies led to precooling as an established agricultural practice.

1916

Stainless steel invented.

Calcium arsenate developed for use on boll weevil.

United States Grain Standards Act passed.

Federal Farm Loan Act passed.

Standard Container Act passed.

Federal Highway Act provided for cooperation with states in construction of rural post roads.

Japanese beetles discovered in New Jersey. ([more information](#))

1917

A system for growing modern hybrid corn developed. ([more information](#))

European corn borer discovered near Boston, MA.

United States entered World War I.

U.S. grade standards for potatoes issued, representing the first official grade standard for a fruit or vegetable issued by USDA.

Pink bollworm discovered in Texas.

Demonstrated that raw milk could transmit a bacterium, *Brucella abortus*, that causes brucellosis in cattle and undulant fever in humans.

Long-term study of dairy improvement started; increased production per cow from 542 pounds of butterfat in 1920 to more than 720 pounds today.

World War I ended.

Discovered that relative day and night length control flowering, known as photoperiodism. ([more information](#))

Discovered existence of pathogenic races of plant fungi.

Discovered temperature necessary to kill trichinae.

1919

Term 'biological control' coined. ([more information](#))

1920

Of gainfully employed persons, 27 percent were engaged in agriculture.

Soil classification system developed. ([more information](#))

[American Farm Bureau Federation](#) formally organized.

Warner-Bratzler shear instrument developed to objectively measure meat tenderness.

1921

Field of population genetics in animal breeding founded.

1922

Capper-Volstead Act provided legal status for agricultural cooperatives.

Honeybee Act prohibited the importation of adult honeybees.

Developed a method for dusting cotton fields with calcium arsenate to protect cotton against boll weevil. ([more information](#))

1923

Tobacco mosaic virus isolated; established that viruses cause many plant diseases.

First annual farm outlook conference held.

Congressional distribution of seeds discontinued.

Commercial hybrid seed corn developed. ([more information](#))

1924

Magness-Taylor pressure tester invented to measure fruit ripeness.

First planes designed specifically for crop-dusting operations in the Mississippi Delta.

President Coolidge appointed a nine-man President's agricultural conference.

1925

Tennessee outlawed teaching evolution in school; Scopes trial held in Dayton, TN.

Clarence Birdseye pioneered quick-freezing and frozen food. ([more information](#))

Three to 4 man-hours of labor required on 1 acre to produce 20 bushels of wheat.

Discovered that ethylene is the agent responsible for initiating fruit coloring in oranges.

Purnell Act authorized funds for research by agricultural experiment stations on economic and social problems of agriculture.

1926

USDA began inspection of live poultry.

Successful light gasoline tractor invented.

First auxin, a plant hormone, discovered.

Targhee breed of sheep developed.

1927

[U.S. National Arboretum](#) established by Congress.

Federal beef grading initiated.

USDA conducted tests on methods for removing lead-arsenate spray residues from apples and pears to meet export tolerances.

1928

Bouquets carried on Graf Zeppelin's first transatlantic flight showed the role air travel could play in transporting insect pests and plant diseases. ([more information](#))

Antibacterial properties of penicillin discovered by Sir Alexander Fleming. ([more information](#))

Soil erosion identified as serious threat to agricultural productivity. ([more information](#))

Capper-Ketcham Act provided extension work in agriculture and home economics for men, women, boys, and girls.

Buchanan Amendment provided first Congressional appropriation for soil erosion research by USDA. ([more information](#))

Wool Standards Act passed.

Future Farmers of America established.

Method developed for obtaining auxin.

Jersey highbush blueberry released.

Ten regional erosion experiment stations set up.

1929

Great Depression began.

Growing plants in water, hydroponics, invented.

Mediterranean fruit fly discovered in Florida.

First airplane seeding of rice in California.

Showed that plants first inoculated with one virus are protected from infection of another closely related virus or a mild strain of the same virus, known as 'cross protection.'

1930

Of gainfully employed persons, 21.5 percent were engaged in agriculture.

Perishable Agricultural Commodities Act passed.

Plant Patent Act enabled the patenting of new plant varieties, excluding sexual and tuber-propagated plants.

Tariff Act prohibited imports of meat and animals from countries infected with foot-and-mouth disease. ([more information](#))

Strain 19 of *Brucella abortus* developed; formed basis of brucellosis vaccine.

First cross made in the country's only national pecan breeding program.

Controlled citrus blackfly in Cuba using biological control. ([more information](#))

1931

First electron microscope built.

Fungus that causes Dutch elm disease introduced into the U.S.

US-1 released; first USDA sugar beet germplasm.

New citrus fruit 'tangelo' developed, a grapefruit and tangerine hybrid. ([more information](#))

1932

Use of carbon dioxide tested as method to retard produce decay; eventually led to method for protecting fruits in transit.

Prepared pure crystals of vitamin C from lemon juice.

Katahdin released, first pest-resistant potato variety.

1933

Developed technique to produce spores in commercial quantities. Allowed first large-scale use of a disease organism to control an insect pest, Japanese beetles. ([more information](#))

Suter-Webb cotton fiber measure invented. ([more information](#))

Tennessee Valley Authority Act passed.

Farm Credit Administration established by Executive Order 6084.

Soil Erosion Service established, later known as Soil Conservation Service, and today as Natural Resources Conservation Service. ([more information](#))

Pantothenic acid discovered. ([more information](#))

Stiff Stalk Synthetic released, one of the most important germplasm sources of corn lines. ([more information](#))

1934

Worst drought in U.S. history took place in the Great Plains and covered over 75 percent of the country. ([more information](#))

Jones-Costigan Sugar Act passed; replaced by Sugar Act in 1937.

Bankhead Cotton Control Act passed.

Taylor Grazing Act gave U.S. Department of the Interior power to regulate grazing on public lands in the West.

Jones-Connally Act authorized appropriations for research to eliminate disease from beef and dairy herds.

Kerr-Smith Tobacco Control Act approved.

Glanders of horses eradicated.

Accomplished first typing of a strain of bacteria with bacteriophage.

USDA and Iowa State Experiment Station imported Danish Landrace hogs.

Carizzo citrus rootstock released, base for more than 60 percent of all United States citrus trees. ([more information](#))

Line 1 Hereford program started; one of the longest continuing beef cattle line-breeding programs in the U.S.

1935

Bankhead-Jones Act provided for expansion of agricultural research.

Sulfa drugs discovered.

Methods for genetic evaluation of beef cattle pioneered.

De Rouen Rice Act passed.

Tobacco Inspection Act passed.

Two farmers out of every five were tenant farmers.

Initiated National Poultry Improvement Plan to improve production and marketing qualities of chickens and turkeys through performance testing.

National Tillage Machinery laboratory established at Auburn, AL to study factors applicable to the design of tillage implements.

Developed concept of vegetative waterways, which led to more than 500,000 miles of waterways that channel runoff and prevent severe gully erosion.

1936

Discovered that selenium is absorbed from roots and carried to the foliage where it kills aphids; the first systemic insecticide.

First hybrid crop cultivar (an onion) developed using cytoplasmic male sterility.

Weymouth highbush blueberry released, earliest cultivar in New Jersey.

Demonstrated that water normally lost to runoff could be used to increase growth of grasslands using diversion dams and contour dikes.

1937

First soil conservation district in the U.S. organized. ([more information](#))

Published first electron micrographs of bacteria.

Observed that an insecticide applied to bean plants was translocated from the outer surface of the treated leaves to leaves that developed after the application.

Concho hard red winter wheat released.

1938

Agricultural Adjustment Act established four regional research centers to develop new uses for farm products. Locations were Wyndmoor, PA; Peoria, IL; Albany, CA; and New Orleans, LA. ([more information](#))

Food, Drug and Cosmetic Act passed.

Bacillus thuringiensis first sold as insecticide. ([more information](#))

Insect-sterilization technique for mating disruption proposed. ([more information](#))

First artificial breeding cooperative organized for dairy cattle.

Reported filarial dermatosis of sheep, developed treatment.

1939

World War II began in Europe.

Usefulness of crossbreeding to improve the efficiency of beef production demonstrated.

Federal Seed Act required truthful labeling on vegetable seeds in interstate commerce and prohibited importation of low-quality seed.

First grade standards were issued by USDA for a frozen product—peas. ([more information](#))

1940

Developed and tested soilless media for plant growth; vermiculite discovered.

Of gainfully employed persons, 18 percent were engaged in agriculture.

Actinomycin antibiotic obtained from soil microorganisms.

Developed new compound, ascorbyl palmitate, from vitamin C and a long-chain fatty acid; used as an antioxidant in vegetable soils and as a dietary supplement.

First commercial controlled-atmosphere storage for apples constructed.

1941

Mildew- and rot-proof fabrics and bandages developed. ([more information](#))

First simple daily nutrition guide published. ([more information](#))

Beltsville small white turkey developed, ancestor of today's commercial turkeys.

United States entered World War II.

Deep-vat fermentation developed in Peoria, IL, allowing mass-production of penicillin. ([more information](#))

War Powers Act passed.

International Harvester Company perfected a one-row high-drum picker for cotton.

Utilization Research and Development Divisions established by USDA in Pennsylvania, Illinois, Louisiana, and California to develop new industrial outlets for agricultural products and crop residues. ([more information](#))

Japan attacked Pearl Harbor.

Found genetic resistance to corn earworm in a line of flour corn.

Demonstrated that methyl bromide is a broad-spectrum biocide and controls nematodes.

1942

First nuclear reactor built.

Growth regulation ability of 2,4-D (2,4-dichlorophenoxyacetic acid) discovered; chemical was later widely used as an herbicide.

Postulated important physiological effect of rutin on capillary blood vessels; discovered that buckwheat was economical source of rutin and developed manufacturing procedures.

Emergency Rubber Production Act passed.

Discovered chemical structure of DDT; military began to use chemical to protect against typhus. ([more information](#))

Rhodesgrass mealybug identified in the U.S.

Induced ovulation in domestic fowl.

Lincoln Smooth Bromegrass released, dominant variety for several years.

Ranger alfalfa released, dominant variety for several years.

Effective huller developed for harvesting castor beans.

Dourine of horses eradicated.

1943

Aerosol container for dispensing insecticides patented. ([more information](#))

Palatable dehydrated eggs developed.

United Nations Relief and Rehabilitation Administration established.

Office of War Mobilization established.

Citrus canker eradicated from seven gulf states.

Developed method for cleaning Navy airplane engines by blasting them with ground corn cobs.

Willamette red raspberry released; predominant Northwest cultivar until 1980s.

Research to create fruit essences began; led to development of concentrated frozen apple and grape juices.

Found that linoleic and linolenic acids were retarding process of making synthetic rubber from butadiene and styrene; solved by partial hydrogenation.

Texas cattle fever eradicated. ([more information](#))

Coastal bermudagrass released, revolutionized forage grass production in the southern U.S.

Buffalo alfalfa released.

1944

Discovered epoxidation, which allowed production of flexible vinyl.

Organic Act provided for control and eradication of certain animal and plant pests and diseases.

Antibiotic streptomycin isolated from soil microorganisms.

Complement fixation test to diagnose anaplasmosis in cattle developed.

Comstock mealybug controlled in eastern U.S. using biological control. ([more information](#))

1945

World War II ended.

Food and Agriculture Organization formed by the United Nations.

Developed a process for preparing purified grade of oleic acid from inedible animal fats, used in cosmetics and as lubricants in textile mills.

Bankhead-Flanagan Act provided for expansion of county extension work.

Germany and Japan surrendered to the Allies.

Developed cytoplasmic male-sterile sugar beet lines; led to emphasis on hybrid development.

Established that clay particles are minerals with crystalline structures.

Developed x-ray diffraction to analyze fertilizers.

Established fresh fruit maturity standards for marketing oranges.

1946

National School Lunch Act passed.

Technique developed to produce high-quality frozen orange juice concentrate. ([more information](#))

Research and Marketing Act passed.

Oriental fruit flies found in Hawaiian Islands. ([more information](#))

Released 5,000 beetles as biological controls against Klamath weed; the first successful attempt in the U.S. to control a weed with a plant-eating insect. ([more information](#))

Vigo soft red winter wheat released; one of first of these types to withstand leaf rust.

1947

Avian leukosis virus first isolated.

Federal Insecticide, Fungicide, and Rodenticide Act passed; replaced Insecticide Act of 1910.

First U.S. case of scrapie diagnosed in sheep.

Organophosphate pesticides developed. ([more information](#))

Saw-type lint cleaner for cotton gins developed. ([more information](#))

Congress authorized cooperative project with Mexico to eradicate foot-and-mouth disease there. ([more information](#))

National Foundation Seed Project organized by USDA to assist the states in the rapid buildup of foundation seed supplies.

Discovered antibiotic polymyxin.

Marfed soft white spring wheat released, the major spring wheat grown in Washington until semidwarf wheats were introduced.

1948

Saint Anthony Falls stilling basin designed. ([more information](#))

Time-temperature tolerance project began; ultimately developed nine principles for freezing vegetables that remain the industry standard. ([more information](#))

Cortisone found to relieve rheumatoid arthritis.

Screened 6,600 plant species for useful chemicals. Found Mexican yam to have highest yield of compound diosgenin, an ingredient that can be used to produce cortisone.

Chehalem trailing blackberry released; one of the first high-quality processing cultivars.

Kennebec potato released.

Synthesized esters determined to be similar to the active constituents of pyrethrum; one of these synthetic insecticides, allethrin, used in aerosol pesticide bombs. ([more information](#))

1949

Methods developed to remove off-taste in soybean oil, including deactivating trace metal contamination and reducing content of rancidity-causing linolenic acid. ([more information](#))

Radiocarbon dating invented.

Bluecrop highbush blueberry released, the most widely planted blueberry cultivar in the world.

1950

North Korea invaded South Korea.

Diffusion photometer designed; first light-scattering instrument to measure the size of molecules.

Economical methods for producing dextran developed; first used as alternative to blood plasma in Korean War.

National Poultry Improvement Plan authorized.

Of gainfully employed persons, 11 percent were engaged in agriculture.

Exotic Newcastle disease detected in the U.S.

Discovered that highly chlorinated naphthalene, a wax used in certain greases and oils, caused hyperkeratosis (X-disease) in cattle.

New form of streptomycin discovered.

Xanthan gum developed; an edible food gum fermented from glucose by a microorganism.

Discovered the cause of salmon disease in foxes and dogs; the first rickettsial disease agent found to be transmitted by an internal parasite.

Separated the milk protein casein into three components. ([more information](#))

Ryder lettuce released.

1951

Used modified live-virus vaccines to protect swine from hog cholera. ([more information](#))

Combine harvester-huller designed to harvest castorbean crop.

Found that vitamin E prevented yellow-fat disease in mink and pigs.

1952

Spirochetes isolated from cattle rumen.

Self-propelled center-pivot overhead sprinkler patented.

Tristeza identified in Florida.

Parasitic wasps released as biological control against pink bollworm. ([more information](#))

Discovered that rust in containers causes bacterial spores to form in milk left standing at room temperature.

Male-sterile plants of Day sorghum discovered.

Virus-free strawberries developed.

Studied effect of chilling temperatures on tomatoes; led to use of moderate temperatures in transportation of tomatoes and resulted in better ripening and less decay.

Discovered phytochrome. ([more information](#))

Pocahontas strawberry released.

1953

[Agricultural Research Service](#) created.

James Watson and Francis Crick describe double-helical structure of DNA.

Discovered that plants use the red part of sunlight to launch growth changes. ([more information](#))

Demonstrated use of light transmittance to detect blood spots in eggs; technology later applied to detect hollow heart and black spot in potatoes, water core in apples, and changes in their ripening.

Discovered THPC, compound that imparts fire resistance to cotton fabrics. ([more information](#))

Khapra beetle found in the U.S.

Korean War ended.

First calves born as a result of embryo transfer from donor to recipient cows.

Developed nystatin, first useful fungal antibiotic.

Growth modifier MOPA (alpha-methoxyphenylacetic acid) developed.

Nordan crested wheatgrass released, exceptional drought resistance.

Discovered that adding aureomycin and vitamin B12 to feed reduced loss of rabbits from enteritis by 75 percent.

Demonstrated that MOPA could move from one plant to another through adjacent roots.

Reported first case of advanced natural parthenogenesis in birds; spontaneous development of embryos without normal fertilization.

Vernal alfalfa released, important in arid areas.

Alaska lettuce released.

Jade lettuce released.

Coronet peach released.

Maygold peach released.

Suwanee hybrid bermudagrass released; used for pasture.

Tiffine released; hybrid bermudagrass for turf.

Developed differential centrifugation method to purify plant viruses.

Red LaSoda released; most popular red-skin potato in the South.

1954

DEET (N, N-diethyl-m-toluamide) insect repellent developed.

Gas-liquid chromatography used to study flavors and aromas.

Process for making instant potato flakes developed.

Watershed Protection and Flood Prevention Act passed.

Agricultural Trade, Development, and Assistance Act (Public Law 480) passed.

Near-infrared reflectance spectroscopy invented.

Test developed to detect visceral lymphomatosis in live chickens.

Discovered that avian lymphomatosis virus can be present in hens that appear normal and that it is shed in their eggs; showed that a hen injected with virus imparts passive immunity to the chicks.

Vaccine developed to protect chickens from visceral lymphomatosis.

Discovered beneficial nematode that carries bacterial septicemia to insects.

First spray vaccine developed to immunize mink against distemper.

Landmark document for remediating saline soils published: *Diagnosis and Improvement of Saline and Alkali Soils*, Agricultural Handbook No. 60. ([more information](#))

Dixieland strawberry released.

Lee soybean released; first soybean aimed chiefly at disease control. ([more information](#))

Redglobe peach released.

Lahontan alfalfa released; first with high resistance to spotted alfalfa aphid.

Charleston Gray watermelon released.

Delus potato released.

1955

Roma tomato released; still main variety used for tomato paste.

Omar soft white winter club wheat released, multiple gene resistance to common bunt.

Tifblue rabbiteye blueberry released; most widely planted rabbiteye cultivar.

Discovered sesamol from sesame oil and proved synergistic effect with pyrethrum insecticides. ([more information](#))

Mite that carries peach-mosaic disease identified.

Screwworm fly eradicated from Curacao using sterile-fly mating disruption; eradicated from Florida in 1958. ([more information](#))

Rio and Palmetto released, first nonshattering sesame seeds for mechanical harvesting.

Grant soybean released. ([more information](#))

Dual soft red winter wheat released; one of the first with natural resistance to Hessian fly.

Controlled citrus blackfly in Mexico using biological control. ([more information](#))

1956

Soil Bank Act passed.

Density-gradient centrifugation invented.

Marion trailing blackberry released, the most important blackberry cultivar in the world.

Aureomycin-sulfamethazine treatment developed to prevent mortality of chicks with cecal coccidiosis.

Developed new tanning agent for leather, glutaraldehyde.

Transferred rust resistance from a wild grass to wheat.

Strain of tobacco streak virus isolated in peas.

Test for Aleutian disease of mink devised.

Dixie Bright tobacco released.

Bronco oats released.

1957

Civil Rights Act passed.

Sputnik launched.

Laser invented.

Humane Slaughter Act passed.

Poultry Inspection Act authorized compulsory Federal inspection of poultry sold in interstate commerce.

Federal Plant Pest Act passed.

Discovered interferon, an antiviral protein produced by the body to fight viral infections.

Slow virus proposed as cause of kuru; now known as a human spongiform encephalopathy disease.

Pima S-1 long staple cotton released; selected from germplasm with the same name developed by University of Arizona.

Plant estrogen coumesterol isolated from ladino clover; structure determined.

Virus that causes foot-and-mouth disease purified, isolated, and photographed.

Discovered that zinc is effective in treating swine parakeratosis.

Cotton opener-cleaner patented. ([more information](#))

Chemical treatment developed to suppress pollen production; developed male-sterile cotton plants.

Dearing muscadine grape released.

Earliril and Bendril apricots released.

Moapa alfalfa released.

1958

Universal Soil Loss Equation developed. ([more information](#))

National Seed Storage Laboratory set up to provide long-term storage of plant germplasm. ([more information](#))

Food Additives Amendment established. ([more information](#))

Developed continuous method of making jelly with fruit-juice concentrates, instead of single-strength juice.

Discovered that infectious particles from southern bean mosaic virus can move from dead to living cells.

Designed flight-bar roller gin, improved speed of separating cottonseed from lint. ([more information](#))

Designed granular cards for cotton carding machines. ([more information](#))

Blackstone and Garrisonian watermelons released.

Army flax released.

Pinkshipper tomato released.

Brawley sorghum released.

Golden State A, Golden State B, and Lakeland lettuces released.

Hood soybean released. ([more information](#))

Shelby soybean released. ([more information](#))

Gila safflower released.

Garden blue and menditoo blueberries released.

Controlled spotted alfalfa aphid in the U.S. using biological control. ([more information](#))

1959

Food for Peace Program inaugurated.

Phytochrome isolated; demonstrated its role in controlling flowering and seed germination. ([more information](#))

Giant hay baler invented.

Mechanical tomato harvester developed.

Isolated first acidic, aromatic amino acid, meta-carboxy alpha phenylglycine from natural material, iris bulbs.

Shipping fever virus isolated.

Automatic feed handling for poultry from bulk storage bins to feeders developed.

Exotic and Magoon grapes released.

Cody alfalfa released.

Thaxter lima bean released.

Hill soybean released. ([more information](#))

Monon wheat released.

Curt oat released.

Controlled Rhodesgrass mealybug on range grass in Texas using biological control. ([more information](#))

1960

Gypsy moth pheromone discovered; proposed using sex attractants to disrupt mating. ([more information](#))

US-1140 great northern bean released; dominant variety in this seed class for 25 years.

Developed method for shrink-proofing wool called interfacial polymerization; known as the WURLan process.

Revealed that protein similarities between plant and disease organism are involved in susceptibility of the plant to the disease.

Instant sweet potatoes developed.

Discovered mechanism of delayed bitterness in citrus juices and identified enzyme system that prevents bitterness in whole fruit. ([more information](#))

Determined cause and prevention of cockle defect in sheepskins.

Robinson, Osceola, and Lee tangerines released. ([more information](#))

PD-611 tobacco released; first tobacco line resistant to root-knot nematodes.

Wells and Lakota durum wheat released.

Vinall wild rye released.

Utah Synthetic C alfalfa released.

Chinook and Ranier cherries released.

Midway strawberry released.

1961

Path of carbon in photosynthesis determined (Calvin cycle).

Statistical Reporting Service established.

Neutron probe developed for field measurements of soil-water content.

First commercial semidwarf cultivar of a cereal grain in North America released; Gaines high-yield wheat helped launch 'Green Revolution.' ([more information](#))

Feed Grain Act passed

Peace Corps established.

Equine piroplasmiasis reported in the U.S.

Economic Research Service established.

Developed cytoplasmic male-sterile millet. By 1965, Indian scientists had developed a new hybrid from these seeds that yielded 88 percent more grain than common millet. ([more information](#))

Developed method to prevent gelling in canned evaporated milk.

Demonstrated that flavor components in fruit could be incorporated into amorphous sugar that was moisture stable at room temperature; used to fortify flavors of candies, cookies, and cakes.

Discovered that spraying linseed oil mixtures on new concrete prevented damage from salt put on roads to melt ice during winter.

Emerald crownvetch discovered by plant exploration team in southeastern Russian, introduced into Midwest. ([more information](#))

Developed method for measuring pungency of onions by determining amount of pyruvic acid.

Isolated an abscission-accelerating chemical from cotton burs, abscisic acid.

Badger Shipper cabbage released; first with some resistance to clubroot.

Bethel and Kent soybean released.

Woodard blueberry released.

Belle Patna rice released.

Denta sweetclover released; first nonbitter white sweetclover.

1962

Silent Spring published; documented the effect of chemicals on the environment. ([more information](#))

Discovered breeding line that could restore fertility to male-sterile wheat plants.

Library collection of USDAS designated as [National Agricultural Library](#).

Cereal leaf beetle discovered to be established in Michigan.

Purified and structurally identified three soluble ribonucleic acids (RNAs). ([more information](#))

Developed method for built-in permanent creases for wool trousers.

First laboratory test developed to detect bluetongue neutralizing antibody.

Released four inbred lines that resulted in first commercial production of hybrid seed of pearl millet.

Developed methods using calcium to remove strontium-90 radioactivity from wheat and milk.

Developed method using cyclic lighting and chemical retardants to produce compact poinsettias with dark-green foliage.

U-1421 safflower released.

First precision weighing lysimeter with automated data processing developed.

Discovered new sugar in honey, named erlose, resulting from the action of the honeybee enzyme invertase on sucrose.

1963

Virulent-virus hog cholera vaccines outlawed. ([more information](#))

Produced first evidence of large genetic differences in amino acid composition of cereal protein, thereby making possible improvement of the nutritional quality of cereal protein.

Absciscic acid identified.

Slack mercerization developed to improve cotton stretchability. ([more information](#))

Simple test for galactose developed; served as basis for diagnosing infants with galactosemia.

Discovered Chediak-Higashi syndrome in mink and cattle.

Fiber retriever invented to increase efficiency of cleaning section of card in cotton by up to 40 percent. ([more information](#))

Proved that tropical horse tick, *Dermacentor nitens*, can transmit equine piroplasmiasis.

Discovered that wild carrots give sheep acute sensitivity to sunlight, causing sunburn of sensitive areas.

Starch-based polyethers developed and converted to foam; dries as a rigid layer of insulation.

Crane and Orrin Chinese chestnuts released, the only chestnuts that can be grown in the eastern U.S.

Penobscot potato discovered; first with good resistance to leaf roll virus.

Jensen-Haise equation developed.

1964

Agricultural Appropriation Act authorized fifth utilization laboratory at Athens, GA.

Showed that detergents made from fats are biodegradable and produce much less foaming than detergents made from alkybenzene-sulfonates.

Discovered that different plant varieties alter soil pH differently.

Developed plastic frames for bee honeycombs.

Simple method developed to determine amount of available lysine in oilseed meals.

Chemically treated cotton batting created; held its shape better than older versions. ([more information](#))

First field test of devices for an automated irrigation system performed.

1965

United States entered Vietnam conflict.

Discovered molecular structure of transfer RNA. ([more information](#))

Juvenile hormone of insects identified and synthesized.

Durable-press cotton textile (permanent press) developed. ([more information](#))

Water Resources Planning Act passed.

Nugaines soft white winter wheat released; sister to Gaines with resistance to stripe rust and cephalosporium stripe. ([more information](#))

Hood strawberry released, most important processing cultivar for many years.

Light-absorbing pigment called chromosphere discovered as the activating agent for phytochrome. ([more information](#))

Conducted initial field trials using corrugated-wall polyethylene plastic tubing for subsurface drainage; installed tubing with an ARS-developed plow, rather than excavating trenches to install tubing in the soil.

Discovered that addition of vitamins C and E reduced levels of nitrosamines in fried bacon and nitrite-cured products; industry changed processing to minimize consumer exposure to cancer-causing nitrosamines.

Developed a continuous process for making bulgur, while reducing cost by two-thirds; invented WURLD wheat, a chemically peeled, creamy white bulgur that looks like rice.

Abscisin II, a plant hormone that accelerates plant defoliation, isolated.

Tidwarf bermudagrass released.

Spring Pink poinsettia released; first variety with pink bracts and green foliage.

Yakima snap bean released, first commercial snap bean with good resistance to curly top.

Controlled European wheat stem sawfly in the eastern U.S. using biological control. ([more information](#))

Developed Beltsville Universal Computerized Spectrophotometer, which led to commercial development of near-infrared reflectance instruments for analysis of bulk commodities like wheat, corn, and soybeans.

1966

High-lysine corn developed; bred to enhance protein level. ([more information](#))

Eradicated screwworm fly from the U.S. using sterilization. ([more](#))

First monitoring program established to determine effects of typical agricultural pesticide use.

Laboratory Animal Welfare Act passed; renamed Animal Welfare Act in 1970.

Cotton Research and Promotion Act passed.

Discovered that protein is not essential in a milk cow's diet.

Camptothecin shown to have antitumor activity; isolated from *Camptotheca* trees grown by ARS, samples provided to National Cancer Institute as part of a germplasm research project.

Identified methionine as the precursor of ethylene, the plant hormone that promotes fruit ripening.

Smoothstem and Thornfree semi-erect blackberries released, first thornless blackberry cultivars.

Juvabione isolated, a substance in balsam fir wood that prevents immature insects from maturing.

First electron microscope image produced of virus that causes foot-and-mouth disease in infected animal cells. ([more information](#))

Food for Peace program amended to permit the enrichment and fortification of commodities to improve their nutritional quality.

Showed that dairy cows could have protein needs met with low-cost urea instead of high-cost protein feeds; research funded by ARS.

Fortuna released; first rust and sawfly resistant wheat.

Developed method for chemical pruning side buds from chrysanthemums without harming the growing tip.

Conducted initial testing of prototype laser-beam system for controlling depth and grade in subsurface drainage installation equipment. The laser-plane grading system was adopted and modified by industry and is now used worldwide.

Showed that ozone and sulfur dioxide in combination more seriously affected plants than either did alone.

Developed high-calorie, nontoxic fat emulsion for intravenous feeding from purified cottonseed oil and egg lecithin.

1967

Viroids discovered, the smallest known agents of plant disease. ([more information](#))

Wholesome Meat Act passed.

Blueboy released; first semidwarf soft red winter wheat.

Grew Marek's disease-causing virus in the laboratory for the first time.

Developed wheat-soybean tempeh.

1968

Alfalfa blotch leafminer found in the U.S.

Reported that soil eventually controls disease 'take-all' after years of continuously grown wheat.

Determined that lupine is toxic to cattle; caused crooked calf disease or abortion.

Arthur soft red winter wheat released; double the yield of standard Trumbull variety.

Friar plum released.

Team alfalfa released, ozone resistant.

Concept of crop coefficients for use with evapotranspiration developed.

1969

Food and Nutrition Service established. ([more information](#))

Use of modified live-virus hog cholera vaccines outlawed. ([more information](#))

National Environmental Policy Act passed.

Discovered bovine leukemia virus.

Mycoplasma-like organisms discovered.

Discovered bovine C-type virus; later renamed bovine leukemia virus.

A mycoplasma, a type of microorganism associated with animal disease, identified for the first time as the cause of a mechanically transmitted plant disease.

Patented ammoniation process for detoxification of aflatoxin.

Discovered mode of inheritance of Ehlers-Danlos syndrome in dogs and mink.

1970

Farmers made up less than 5 percent of work force for the first time.

Plant Variety Protection Act passed.

Effects of salinity on plant growth determined.

System developed to continuously process raw cotton stock into yarn. ([more information](#))

Council on Environmental Quality established.

Environmental Protection Agency established.

Horse Protection Act passed.

Wheat Research and Promotion Act passed.

Egg Products Inspection Act passed.

One and one-half man-hours of labor required on 1 acre to produce 30 bushels of wheat.

Eurasian pine adelgid found in Hawaii. ([more information](#))

Montcalm kidney beans released.

Identified active ingredient in gypsy moth pheromone; synthesized an attractant, disparlure, as effective as female's natural attractant. ([more information](#))

Continuous chromatography apparatus constructed.

Produced active-synthetic boll weevil attractant, named grandlure. ([more information](#))

Discovered mode of inheritance of cyclic neutropenia in dogs.

Identified and synthesized new class of plant hormones, brassinolides.

First micropropagation of thornless blackberries.

Immunoglobulin IGA discovered in cow's milk.

Killed-virus vaccine for Newcastle disease developed.

Developed process to make sourdough bread outside of San Francisco area.

Tylosin lactate discovered as a treatment for American foulbrood of bees.

NPV of corn earworm registered by FDA; first baculovirus to be registered and mass-produced for commercial use; registered by EPA in 1975. ([more information](#))

Developed first artificially produced crop variety, Higgins buffelgrass, that reproduces by seed, but without fertilization.

Controlled alfalfa weevil in the eastern U.S. using biological control. ([more information](#))

Controlled tansy ragwort on rangelands in the western U.S. using biological control. ([more information](#))

Era released; first semidwarf hard red spring wheat variety.

Kanza alfalfa released.

Developed gas chromatography-mass spectrometry analytical techniques for flavor analysis of fruits and juices.

1971

Microcomputers invented.

Role of enzyme "rubisco" on photosynthesis and photorespiration demonstrated. ([more information](#))

Animal and Plant Health Inspection Service established; responsible for regulatory and control programs relating to disease and pests of animals and plants that were previously carried out by ARS.

Discovered first fertility restorer for sunflower; lines RHA265 and RHA 266; used as male parents to create first hybrid sunflowers planted by farmers in the U.S.

Marek's disease vaccine developed.

First comprehensive study on the effects of feeding aflatoxin to livestock and poultry published.

Both sex attractants of female southern armyworm isolated, must be combined to work. ([more information](#))

1972

First recombinant DNA molecule synthesized.

Improved chemical treatment using THPC and other chemicals, allowing fire-retardant children's sleepwear. ([more information](#))

Federal Water Pollution Control Act passed.

Clean Air Act passed.

Consumer Product Safety Act passed.

DDT use banned in the U.S. ([more information](#))

United States signed 1952 International Plant Protection Convention.

Clean Water Act passed.

Isolated sex pheromones for Mediterranean fruit fly. ([more information](#))

Spiroplasmas discovered, an entirely new class of disease-causing organisms.

Agate alfalfa released.

1973

Endangered Species Act passed.

Flammable Fabrics Act mandated new standards for fire retardancy. ([more information](#))

First gene splicing performed.

Caprine arthritis and encephalitis of goats described.

Flame Seedless released; second most important seedless grape produced in the U.S.

Designed fiberboard box used for exporting citrus. ([more information](#))

1974

Threat to ozone by chlorofluorocarbons proposed.

Safe Drinking Water Act passed.

United States ratified the Convention on International Trade of Endangered Species (CITES).

Viva and Roza pink beans released; most widely grown pink bean varieties for past 25 years.

Climax rabbiteye blueberry released; second most widely planted rabbiteye cultivar.

Swingle citrus rootstock released; Swingle and Carizzo form rootstock for most grafted citrus trees in the U.S. ([more information](#))

Single citrumelo rootstock released, resistant to citrus nematodes and tolerant to citrus blight. ([more information](#))

Flavorcrest peach released.

First book wholly devoted to biological control of plant pathogens published. ([more information](#))

1975

Monoclonal antibodies invented.

Federal Noxious Weed Act provided authority for a regulatory system designed to prevent the introduction of noxious weeds into the U.S. from foreign countries.

Developed pollen substituted as a nutritional additive for bee colonies, Beltsville Bee Diet.

Demonstrated that a fraction of the virus that causes foot-and-mouth disease is not infectious but produces immunity in livestock. ([more information](#))

Cando released; first semidwarf durum variety.

1976

SuperSlurper patented, a combination of starch and a synthetic chemical that absorbs hundreds of times its own weight in water. ([more information](#))

Beef Research and Information Act passed.

Federal Land Policy and Management Act repealed Homestead Act and many other land laws.

Propagated bovine leukemia virus in cell culture.

Daws soft white winter wheat released, outstanding cold hardiness.

Citrus black fly eradicated using lab-reared parasites as biocontrol agents. ([more information](#))

Designed, built, and operated a prototype system to continuously process raw cotton stock into yarn. ([more information](#))

Crystalline sugar produced from sweet sorghum.

Atlantic potato released; number one chipping variety.

Controlled alligatorweed in the southeastern U.S. using biological control. ([more information](#))

Developed rapid, nondestructive technique for determining quality of forages used as feed for livestock, using near-infrared reflectance spectroscopy.

1977

Methods developed to determine exact sequence of DNA.

Demonstrated the stability of the transmissible mink encephalopathy agent.

Developed practice of spraying calcium chloride or calcium nitrate on unsprayed fruit to reduce blemishes.

Discovered direct relationship between *Neotyphodium coenophialum* fungus in fescue and disease in cattle.

1978

United States declared free of hog cholera. ([more information](#))

Cryotherapy proved successful in treating malignant cancer in animals.

Developed technique to accurately measure vitamin D2 in plants, vitamin D3 in animals and their 11 metabolites. ([more information](#))

1979

Smallpox eliminated; the only microbial disease ever completely defeated.

Sunburst tangerine released. ([more information](#))

1980

Lactase enzymes evaluated; provided basis for lactose-reduced dairy products.

Supreme Court ruled that microbes created by genetic engineering could be patented.

Term "transgenic" coined to describe mice that carried a new, recently introduced gene.

NW-63 small red bean released; most widely grown small red cultivar in the U.S.

Discovered that peroxide dissolves lignin in crop residue so that the digestive bacteria in livestock can reach the cellulose fibers.

System developed to hold, transport, and deliver broilers and turkeys from the farm to the processing plant.

Developed vacuum infusion process by removing citrus peel from fresh fruit. ([more information](#))

Stevenson-Wydler Technology Innovation Act passed.

CREAMS: A Field Scale Model for Chemicals, Runoff, and Erosion From Agricultural Management Systems published. ([more information](#))

Eurasian pine adelgid in Hawaii controlled using biological control. ([more information](#))

Marshall hard red spring wheat released.

Nosema locustae became the first protozoan registered as a microbial insecticide in the U.S. ([more information](#))

1981

Foot-and-mouth disease vaccine developed; first effective subunit vaccine for any animal or human disease using gene splicing. ([more information](#))

Isolated antitumor agent sesbanimide from coffee bean seeds.

Developed method for vaccinating chicks against Marek's disease through the eggshell, demonstrating for the first time that resistance to disease could be established by that method.

Determined that locoweed poisoning, in combination with high altitudes, could cause congestive heart failure in cattle.

Discovered plasmids that could be used to breed plants with desirable traits.

Cablegation developed; an automatic surface irrigation system that uses gravity to deliver water.

Columbia root-knot nematode discovered.

Lemhi Russet released; outyields Russet Burbank.

Developed techniques for the first commercial application of nematodes for control of carpenterworm in commercial fig orchards in California.

1982

New infectious agent, "prions," discovered; proposed as cause of transmissible spongiform encephalopathy diseases.

Genetically engineered human insulin produced.

First genetically engineered crop plant developed (tomato).

Developed the tree-banding technique used by homeowners to prevent gypsy moth caterpillars from crawling up tree trunks. ([more information](#))

1983

Polymerase chain reaction devised; replicates large quantities of DNA from a small initial sample.

Discovered "jumping genes," or moveable genetic elements.

Lemont rice released; one of leading varieties grown in Texas, Mississippi, and Louisiana.

Controlled alfalfa blotch-leaf miner in the eastern U.S. using biological control.

1984

First transgenic farm animals born (sheep and pigs).

Tracheal mite found in honeybees.

Alginate gels and granules from seaweed used to encapsulate chemical or biological pesticides.

Bozoisky Russian wildrye released, dominant variety in the West.

Hycrest released, first interspecific hybrid of crested wheatgrass.

1985

Food Security Act established Conservation Reserve Program for highly erodible lands. ([more information](#))

DNA fingerprinting invented.

Hole in Earth's ozone shield discovered over Antarctica.

Chester thornless blackberry released, predominant blackberry of its type in the world.

Discovered rubisco activase, protein responsible for action of rubisco. ([more information](#))

Discovered that chemicals produced by aquatic microorganisms, geosmin and BIV, cause off-flavors in catfish.

1986

[Germplasm Resources Information Network](#) (GRIN) established, the world's most comprehensive database of agriculturally important plants. ([more information](#))

Starch-encapsulation technique for pesticides developed. ([more information](#))

Federal Technology Transfer Act passed.

First genetically engineered vaccine licensed by USDA, for pseudorabies in swine.

Synthesized pheromone from the papaya fruit fly as the first environmentally safe lure for females.

Discovered hormone PTTH that controls growth and molting in gypsy moth. ([more information](#))

Discovered that pyrrolizidine alkaloids—natural chemicals found in hundreds of plants—kill livestock by causing cumulative and irreversible damage to the liver.

Isolated and characterized the structure of insect neuropeptides.

Othello pinto beans released; dominated acreage in the U.S. and Canada from 1988 to 1997.

Developed sunflower hybrids that produce oil several times higher in oleic acid than traditional sunflower oil; provided genetic material to industry to create NuSun hybrids.

Conducted studies that led to *Bacillus thuringiensis* registration as the first microbial insecticide for use on stored grain.

1987

Developed Fast Africanized Bee Identification System (FABIS) to distinguish European honeybees from Africanized honeybees.

First 100-percent soybean ink developed in four colors. ([more information](#))

Released germplasm lines of sunflower with genetic resistance to all known races of downy mildew.

Developed microinjection technique to move a whole chromosome into a single cell of another plant.

Discovered that boron is a nutritionally necessary trace mineral. ([more information](#))

Fallglo tangerine released; Sunburst and Fallglo comprise most of the early season tangerine market in Florida. ([more information](#))

1981

Virus genes transferred to chickens to impart resistance to avian leukosis virus.

First authorized release of genetically altered bacteria outdoors.

Varroa mites found in Wisconsin.

First patent for genetically engineered animal issued.

Madsen soft white winter wheat released; first winter wheat variety in the U.S. with resistance to strawbreaker foot rot.

Discovered that lactose significantly reduced *Salmonella* bacteria in infected chickens.

Proved that antibiotics produced by soil bacteria responsible for take-all decline.

Developed anaplasma probe used to detect infected ticks.

Fortune plum released.

Sparkleberry holly released.

Created first relatively inexpensive and safe soil monolith collection procedure for 70+ milligram soil monoliths for lysimeters.

1890 Initiative by USDA ([more information](#))

1989

Successfully separated living sperm into male- and female-producing batches.

Water Erosion Prediction Project model developed. ([more information](#))

Waldo trailing blackberry released, first thornless trailing blackberry.

Identified a new parasite, *Neospora caninum*, as a cause of birth defects in cattle and sheep.

Isolated and cloned gene that triggers production of ACC synthase; modified gene to block ethylene production and delay ripening of tomatoes.

Ambersweet released; the first orange created by hybridization and selection. ([more information](#))

Discovered the hormone that controls sex pheromone production in moths.

Bounty peach released.

Blackhawk black bean released; the first bean completely resistant to anthracnose.

1990

Oatrim fat replacer for food developed from soluble oat fiber and natural enzymes.

Food, Agriculture, Conservation, and Trade Act passed.

Technique developed to grow taxol-producing cells in tissue culture.

Nonindigenous Aquatic Nuisance Prevention and Control Act passed.

Africanized honeybees entered the U.S.

Demonstrated that genes could be infected using a commercially available inoculation device dubbed "gene gun"

Developed test to rapidly diagnose citrus blight.

With CSREES, launched MSEA (Management Systems Evaluation Area) projects to develop multi-scale farming systems for improved water quality.

With NRCS, designed criteria for soil and water conservation structures, such as vegetative waterways to protect millions of acres from runoff damage.

1991

Rely soft white club wheat released; main club wheat cultivar in the U.S. since 1996.

Ranger Russet potato released.

Discovered first-ever homeobox—region of a gene that enables it to control other genes—in plants.

Patented new soybean inoculant—live, nitrogen-fixing bacteria—that increased soybean yield up to 2.9 bushels per acre. ([more information](#))

Shasta viburnum released.

Diana hibiscus released.

Released Nitrate leaching and Economic Analysis Package (NLEAP), field-scale computer model for predicting potential nitrate leaching

1992

Entire sequence of one out of 16 chromosomes of a yeast identified.

Generated molecular probes to detect citrus canker disease.

SoilGard™, the first commercial biocontrol agent for soil-borne diseases, developed in cooperation with industry.

Identified and cloned genes responsible for antibiotic production in soil bacteria responsible for take-all decline.

First sensitive and specific test for *Babesia equii* antibody developed.

Patented test to differentiate strains of citrus tristeza; a virus that can kill trees. ([more information](#))

Eskimo viburnum released.

Galaxy magnolia released.

1993

First genetic map of blueberry constructed.

Developed paper from chicken feathers.

Showed that deficiency in either selenium or vitamin E can trigger a mutation in a normal benign human virus; first report of a specific nutritional deficiency permitting a nonvirulent virus to become virulent. ([more information](#))

Discovered that latex from guayule does not contain the allergens found in latex from the Brazilian rubber tree.

Potomac pear released.

Developed remote-sensing technology to measure surface soil moisture, temperature, and other landscape characteristics.

1994

Fantesk invented, an inseparable mixture of starch and oil.

Oxygen Radical Absorbance Capacity (ORAC) method of measuring antioxidant capacity automated.

Developed method to genetically modify *Brucella abortus* Strain 19, to differentiate between naturally infected and vaccinated animals.

First genetic linkage maps of cattle and swine constructed.

First sensitive and specific test developed for malignant catarrhal fever in sheep.

Black, emerald grapes released.

1995

First complete genome sequence of a microorganism described.

Little Giant processing blueberry released.

Conducted extensive outdoor tests with PAM, polyacrylamide powder, showing its efficacy in preventing irrigation water from carrying away soil particles as the water flows down a furrow and leading to widespread use.

First two postharvest biofungicides registered with EPA—ASPIRE and BIO-SAVE 11—based on ARS research.

Revised Universal Soil Loss Equation completed. ([more information](#))

Valley Forge and New Harmony elm trees released, tolerant to Dutch elm disease.

Experimentally infected cattle with transmissible mink encephalopathy and scrapie agents.

Dwelley, Sanford, and Myles chickpeas released; resistant to ascochyta blight.

Four water-quality assessment models delivered to NRCS, which developed a comprehensive database/interface system. These models set the standard for resource predictions for over a decade.

Root Zone Water Quality Model (RZWQM) made publicly available. Today the model is used around the world for aiding soil and water management.

1996

Federal Agriculture Improvement and Reform Act established the Environmental Quality Improvement Program and other conservation programs.

Amendments to the Safe Drinking Water Act passed.

Isolated and developed DNA test to identify bacterium that caused swine diarrhea.

First sensitive and specific test for anaplasmosis antibody in cattle developed.

1997

Cloned a plant-derived gene for resistance to a plant virus, the "N" gene.

"Dolly" cloned from an udder cell of an adult sheep.

Phytoplasma discovered as the infectious cause of commercially desirable free-branching growth habit in poinsettia.

Developed technique for large-scale extraction of limonoid glucosides from citrus. ([more information](#))

Trailblazer alfalfa released.

1998

Bacterial microbe mixture PREEMPT developed for competitive exclusion of *Salmonella*.

Method developed to recycle chromium-containing solid waste from leather production.

First genetically engineered vaccine for shipping fever in cattle developed.

First effective lure for German yellowjacket and golden paper wasps developed.

Discovered that dogs are a definitive host for Neospora.

First sensitive and specific test to detect *Babesia caballi* antibody in horses developed.

Gene-based test for Johne's disease in cattle developed.

Bluebyrd plum released.

1999

Executive Order 13112 on Invasive Species signed. ([more information](#))

Modified live-bacterium fish vaccine approved; protects young channel catfish against enteric septicemia.

USDA helps develop P Index, a tool for guiding phosphorous management in order to reduce eutrophication.

Unique plants found for removal of toxic trace elements from contaminated soils and water, as well as for metal recovery.

2000

First DNA sequencing of a plant genome, the flowering mustard *Arabidopsis thaliana*. ARS one of a three-member U.S. team.

Pierce's disease first discovered in U.S.

First cloned transgenic animal produced that carries a gene designed to enhance the health and well-being of the animal. This cow has the potential to produce an enzyme that destroys mastitis-causing bacteria.

Nutrim, obtained from the thermo-mechanical processing of oats, developed and patented as a commercial soluble oat fiber nutraceutical.

First pathogenic bacterium identified that does not need or use iron. The bacterium causes Lyme disease in humans.

Demonstrated that pure prion proteins can trigger normal proteins to change shape and become infectious.

Molecular technique developed that will enable researchers to induce mutations in the Marek's disease herpesvirus genome, called overlapping cosmid clone library (OCCL).

First soybeans with complete nematode resistance developed. ([more information](#))

The major human allergen in soybean seed suppressed by sequence-mediated gene silencing in transgenic soybeans. ([more information](#))

Green Dixie, the first green blackeye-type southernpea, released.

Biomass Research and Development Act.

ARS-imported Russian honey bees transferred to the U.S. honey bee industry, resulting in honey bees resistant to parasitic mites.

Food Safety Initiative, modified food safety inspections to decrease foodborne illnesses.

Chemicals that induce an otherwise healthy plant to form a tumor to resist infection—called bruchins—discovered.

First molecular map of the ribosome, the cell's essential protein factory, completed.

2001

Polyphenolic compounds found in blueberries and cranberries shown to guard against vascular diseases and age-related memory losses.

DNA-based method refined to quickly detect the soybean rust pathogen, *Phakopsora pachyrhizi*, a threat to 2.9 billion acres of U.S. soybeans.

USDA 103, a catfish line with improved feed efficiency and faster growth, released jointly with Mississippi State University Agriculture and Forestry Experiment Station the first such improvement in over 50 years.

First piglet cloned, by ARS scientists and colleagues at the Roslin Institute in Scotland.

Research headed by ARS showed that *Bt* transgenic corn, developed to resist crop pests and reduce pesticide use, poses no significant risk to monarch butterflies.

Zinc-transport gene cloned from alpine pennycress, an important development in the field of phytomining (using plants to recover metal).

A finding that selenium deficiency increases virulence of human influenza A virus in mice has major public health implications.

Released SITES, a landscape management tool being used to rehabilitate thousands of U.S. earthen dams. Watersheds reliant on these dams provide Americans with \$800 million in benefits each year. ([more information](#))

2002

Gave organic strawberry growers the first technically sound information about cultivar performance under organic conditions.

Farm Security and Rural Investment Act passed to address water and other environmental issues. Programs include the Conservation Security Program, which created a reward system for eco-conscious farmers.

Genetically engineered a tomato to boost its levels of good-for-the-body lycopene. This is the first food to be nutritionally improved with the help of biotechnology. ([more information](#))

Transferred a mite-resistant line of bees to breeders who are sharing them with beekeepers. The bees possess a special trait that naturally guards them against the bee industry's number one enemy, varroa mites. ([more information](#))

Demonstrated that improving nitrogen fixation and phosphorus acquisition in legumes would reduce the need for artificial fertilizers. ([more information](#))

Developed a DNA-based test for rapidly detecting avian influenza with the help of scientists at the Animal and Plant Health Inspection Service.

2003

Helped successfully corral the noxious western weed known as leafy spurge. After a five-year-assault, the weed was reduced by 85 percent at four demonstration sites; herbicide use reduced by 95 percent.

Efficient manure/wastewater treatment system developed to capture nutrients, improve water quality, reduce emissions of ammonia and nuisance odors, enhance water availability for water reuse and kill harmful pathogens.

Created an all-natural glue out of heat-loving bacteria and plant material. Could be a valuable byproduct of ethanol production. ([more information](#))

USDA launches Conservation Effects Assessment Project to quantify benefits associated with cropland conservation practices. ([more information](#))

Found that increased concentrations of atmospheric carbon dioxide alter the expression of over 30 genes in a model plant, including an important one involved in photosynthesis.

December tests confirm the first case of BSE on U.S. soil.

Sequenced *Mycobacterium paratuberculosis*, the causal agent of Johne's disease, an affliction of cattle and other ruminant animals that costs the U.S. dairy industry about \$200 million a year. ([more information](#))

Identified a gene variation in cattle affecting tenderness in beef, which could lead the way to breeding approaches that would allow for more tender cuts of beef. ([more information](#))

Sunbutter, a sunflower seed spread, and peanut butter alternative is made available to the public. ([more information](#))

Discovered a peanut variety lacking a major allergen. Peanut allergies, which can be fatal, affect over 1.5 million Americans. ([more information](#))

Sequenced four *Listeria* genomes in association with The Institute for Genomic Research. This genetic knowledge is crucial to battling food borne illnesses.

Found that barley is as effective as oats in reducing serum cholesterol, which resulted in an FDA-approved health claim. ([more information](#))

2004

ARS DNA analysis confirms the first U.S. cow to test positive for BSE was imported from Canada.

"Defender," the first North American late-blight-resistant potato cultivar, is released. ([more information](#))

Hawaiian fruit fly populations reduced, using biologically based tools developed by ARS. ([more information](#))

Helped sequence the first agricultural insect and first domestic animal, the honey bee. ([more information](#))

Chicken genome sequenced and annotated by an international consortium led by Washington University–St. Louis. ([more information](#))

Released databases for components in food that are believed to have important health benefits, such as carotenoids, isoflavones and proanthocyanidins. ([more information](#))

Showed that vitamin E reduces upper respiratory infections in the elderly. ([more information](#))

Published "U.S. Agriculture and Forestry Greenhouse Gas Inventory: 1990-2001." Helped develop emissions and sinks estimates for livestock, cropland and ranges.

2005

ARS scientists deliver the Wind Erosion Prediction System (WEPS), a tool for forecasting wind erosion damage, to the USDA's Natural Resources Conservation Service for implementing across the nation. ([more information](#))

ARS scientists contributed to an international research effort to characterize and assess the highly pathogenic H5N1 avian flu from South Korean poultry. Discoveries helped shape regulatory responses to the outbreaks.

Updated computer model SWAT (Soil and Water Assessment Tool) released to address water pollution on federal, state and local levels. Represents over 30 years of data. ([more information](#))

Demonstrated how strategic use of irrigation water can reduce water use and boost its quality. This practice is now being used on millions of acres across the American West, where irrigation can consume up to 90 percent of available water resources.

Found that insects move en masse for safety, a discovery that could help predict swarms of crop-destroying insects, like locusts and Mormon crickets. ([more information](#))

New antibiotic for treating American foulbrood disease in honeybees transferred to industry. ([more information](#))

Three new cotton lines released, combining the fiber quality of Acala-type cottons and the heat tolerance of Delta-type cottons.

Thermal defoliator developed to allow eco-friendly, chemical-free defoliation of cotton. ([more information](#))

New fungal genes and markers related to mycotoxin biosynthesis identified and Expressed Sequence Tag libraries established.

Transferred the first, noninvasive beef tenderness prediction system to industry, which is expected to have a multi-million dollar impact on the beef industry and consumers.

With the help of gene transfer technologies, produced dairy cows that are resistant to mastitis. ([more information](#))

Developed an edible coating to keep sliced apples fresh. Being used by restaurants, stores, and the School Lunch Program. ([more information](#))

Released the "What's in the Foods You Eat" search tool, greatly expanding the nutrition information on foods available to consumers. ([more information](#))

Energy Policy Act increased biofuels research funding.

2006

Bovine genome sequenced and assembled by international consortium led by the Baylor College of Medicine Human Genome Sequencing Center.

In July 2006, the U.S. Food and Drug Administration approved an ARS-developed cotton wound dressing for use by patient with chronic wounds. This discovery will benefit cotton farmers by increasing the volume of U.S. value-added cotton products.

ARS scientists developed a new method to detect Norwalk virus—a common viral food contaminant. Public health agencies have a critical need for simpler, faster, and more sensitive detection methods of this virus.

ARS scientists designed two handheld portable inspection devices for sanitary inspections of food processing plants. A U.S. patent application for the technology was submitted.

In cooperation with the U.S. Environmental Protection Agency, ARS scientists developed a geographic information system (GIS)-based hydrologic modeling tool that integrates national watershed data and state-of-the-art environmental assessment and modeling tools into one convenient package.

ARS scientists developed a method to quantify E. coli O157:H7 at levels less than 100 cells per gram of soil, manure, or water. The method demonstrates that E. coli O157:H7 can survive at least 45 days in soil suggesting aggressive methods are needed to control pathogens in the environment.

On July 12, 2006, the California Department of Fish and Game formally declared the invasive marine algal weed, *Caulerpa taxifolia*—that threatened over 600 miles of western coastal subtidal habitat—eradicated. This was achieved through cooperative efforts with ARS scientists. ARS scientists developed the first-ever quarantine irradiation treatments for coconut scale and white peach scale pests.

ARS scientists developed the first-ever quarantine irradiation treatments for coconut scale and white peach scale pests.

A newly released pear variety—Sunrise—fills the need for an early-season pear with excellent fruit quality and appearance, and with resistance to the devastating disease known as fire blight.

2007

A multiplex real time reverse transcriptase polymerase chain reaction (RT PCR) assay was developed to enhance the ability to detect endemic virulent Newcastle Disease viral strains circulating in poultry and to prevent future outbreaks.

Development of Bovine SNP50 DNA Assay, now the standard for cattle genome research and genetic prediction around the globe. It significantly increases the accuracy of genetic evaluations and the rate of genetic progress in the dairy industry. ([more information](#))

Developed Heat Stress Forecasting website in cooperation with the National Weather Service and the National Oceanic and Atmospheric Administration to assist feedlot managers in providing proper care and management for cattle in periods of heat stress. ([more information](#))

ARS scientists found that children who skipped breakfast were less attentive and had slower visual cue response times than children who ate breakfast.

ARS scientists found that storage of cotton bales for at least two years leads to a significant reduction in yarn strength as well as an increase in yellowness. Both factors are associated with inferior quality.

Foods fried in mid oleic/low linolenic soybean oil had better flavor, longer shelf life and more tocopherol retention than did the hydrogenated soybean oil.

Corn production in tile-drained soils leads to high nitrate concentrations in drainage water that discharges into streams. A simple biofilter composed of wood chips buried in trenches adjacent to subsurface tiles can remove 60-70 percent of the nitrate from the tile drainage.

ARS scientists led in the development of a new, advanced wind erosion prediction software—the wind erosion prediction system (WEPS)—which allows growers to select the right approach to prevent erosion and also predict emission of the tiny dust particles known as PM10 that may pose risks to human health and the environment. ([more information](#))

ARS scientists showed that elevated CO₂ protects peanut plants from the negative effects of ground level ozone. These results will be useful in predicting peanut response to climate change and in choosing proper peanut varieties for specific locations.

Long-term studies, by ARS scientists, of plant composition under various livestock stocking rates show that excluding livestock grazing on northern Great Plains rangelands is not the best strategy for improving and maintaining biodiversity and ecological health.

Research by ARS scientists has shown that high moisture corn in the feed reduces production of odorous compounds from beef manure compared with dry rolled corn, due to a decrease in excretion of starch and malodorous fatty acids.

2008

ARS researchers evaluated the ability of a new recombinant brucellosis vaccine to protect against infection and disease in bison. The new vaccine was safe for use in bison following experimental challenge. ([more information](#))

Introduction of four key insect natural enemies of the tree from its native range in Australia effectively restored the Everglades to a more natural state, allowing native species of plants and animals to increase in numbers. ([more information](#))

Following 1739 people for about five years, ARS scientists found evidence suggesting low levels of vitamin D may adversely affect the cardiovascular system.

In the first well controlled, longitudinal study to examine the effect of soy infant formula on brain development, ARS scientists found that resting brain electrical activity, a measure of brain development, did not differ between infants fed milk based or soy based formula during their first six months of life. ([more information](#))

ARS scientists found that women consuming diets designed to meet dietary recommendations for whole grain consumption were about one third less efficient in absorbing iron from the diet. This new information will be valuable for future revisions of the Dietary Guidelines.

A new dehairing process based on alkaline sodium percarbonate eliminates the use of sulfide (both a health and environmental hazard) from the tannery and eliminates sulfide from the waste stream.

ARS researchers developed starch microbeads containing heptanone and essential oils that control Varroa mites as slow release agents to release miticides to control parasitic mites in honeybee colonies.

ARS scientists in California, were the first to publish gene sequences for *Brachypodium*, a model grass plant, and switchgrass. The sequence data generated will accelerate efforts to breed better varieties of perennial, herbaceous energy crops such as switchgrass. ([more information](#))

ARS researchers, evaluating the efficiency of properly managed ditches in keeping agricultural runoff containing pesticides from polluting nearby water bodies, found that ditches can trap 60 to 90 percent of commonly used herbicides and insecticides carried in runoff water, and therefore appear to be a simple, low tech, inexpensive way to improve water quality when properly managed.

In cooperation with Ohio State University, ARS scientists have successfully modified ground penetrating radar equipment to locate operational and non-operational tile lines. Estimates suggest this detection method will save farmers and land improvement contractors about \$10 million annually throughout the United States and will be an effective way to mitigate agricultural runoff that contributes to the Gulf of Mexico's nutrient loading.

ARS scientists and their cooperators developed an updated version of the USDA nitrogen computer simulation model, the Nitrogen Loss and Environmental Assessment Package (NLEAP), which can predict nitrogen form, application rate, timing, and application alternatives for different cropping systems and conditions. ([more information](#))

ARS released, FirstStrike, a new variety of Slender Wheatgrass which proved to be equal to or superior to other commercial varieties. FirstStrike has been adapted by 42 Department of Defense facilities encompassing 1.3 million acres of land regularly reseeded following training exercises. ([more information](#))

2009

Determined the safety of meat from pigs infected with the 2009 Pandemic A/H1N1 influenza virus.

Implemented the first genomic evaluations for the dairy industry using the BovineSNP50 DNA Assay and related technologies resulting in increased accuracy and decreased generation interval for the genetic evaluations that combine to increase genetic progress for the dairy industry. ([more information](#))

An international consortium including ARS resources and leadership completed the swine genome sequencing project. ([more information](#))

Discovered the first stereospecific chemical receptor in a mosquito, greatly improving the ability to design attractants and repellents.

In one of the most heralded genetic engineering achievements in agriculture of the past 15 years, ARS scientists were integrally involved in the development of "Golden Rice," a rice engineered to provide enough beta carotene that is readily converted to vitamin A to satisfy the requirements for this essential vitamin. ([more information](#))

Development of a prototype pressure chamber and camera system that finds very small cracks, called microcracks, in fresh eggshells, helping the egg industry find cracks that can often go undetected during grading. ([more information](#))

ARS scientists developed and fabricated a large sample pressure system for measuring cotton samples for use on multiple types of bench top color spectrophotometers, yielding significant improvements in color measurement consistency and variability over the present manual sampling systems for large fiber samples.

ARS researchers developed an environmentally friendly finishing process to counteract ultraviolet and heat degradation of leather, strengthening the competitiveness of the U.S. hides and leather industries by encouraging environmentally friendly production, while imparting better quality to the finished product.

NRCS and ARS worked together to develop a prototype Nitrogen Trading Tool that can predict nitrogen losses across a range of soils, climate, crops, and management practices. ([more information](#))

Second generation swine wastewater treatment system provides environmentally superior technology at a lower cost. ([more information](#))

Development of an online nitrogen management tool describing best management practices for dairy farms that utilize a whole farm perspective. The web site is an important resource for Extension agents, NRCS staff, and consultants as they write nutrient management plans for Northeastern dairies.

To assist growers in managing salinity in recycled irrigation waters, ARS scientists in collaboration with researchers at the University of California Davis, developed a Salt Management Guide and accompanying CD that includes an extensive list of plant species suitable for water reuse systems.

ARS scientists found that managing mixed forages lowers risks to pasture productivity and farm profitability during droughts.

2010

Safer, more effective vaccines against foot-and-mouth disease (FMD) virus developed. The new vaccines make it possible to distinguish between vaccinated versus infected animals, which could greatly reduce animal losses in the event of an outbreak.

Completed the turkey genome sequence project, a collaborative effort conducted by ARS scientists, the poultry industry and academic stakeholders. ([more information](#))

Discovered FasTrack tree breeding technique, which promotes early flowering and fruiting, and enables cycles of tree breeding to be accomplished faster than conventional breeding. ([more information](#))

Developed bean molecular markers, released to assist legume breeders worldwide. Transferring these ARS-developed molecular markers is consistent with the USDA Feed the Future commitment to be actively engaged in global food security efforts.

ARS research established for the first time, that concentrations of vitamins C, folate, E, K, and pro-vitamin A in spinach leaves exposed to the kind of lighting used in supermarket produce sections will increase during storage, deterring some concerns about diminishing nutritional quality of produce in retail settings. ([more information](#))

2011

Developed a new instant corn-soy blend emergency aid food, which is nutritionally fortified, and has a one-year shelf life. Twenty metric tons of this new emergency aid food was shipped to Haiti in 2011 through a grant from the National Institute for the Severely Handicapped. This effort is feeding over 3,000 malnourished children and provides jobs for 128 disabled employees in the United States. ([more information](#))

Received the first patent for a new insecticide against mosquitoes based on cutting-edge genetic technology called "Inhibitory RNA Technology". This method produces insecticides that are highly specific for the target insect and completely safe for all other species and the environment.

Developed low-oil frying batter, a gluten-free, rice-based frying batter that reduces oil uptake by as much as 50 percent. The technology has been commercialized by an industrial partner with projected economic impact of \$8 million by 2014 from sales of the product and creation of 100 new jobs in four states.

Discovered the pheromone attractant for the brown marmorated stink bug, an invasive species that threatens the fruit industry on the East Coast. This chemical will be an essential part of returning fruit orchards to profitability by providing tools for trapping and monitoring. ([more information](#))

ARS released a hard white winter wheat with resistance to the wheat stem rust (UG99) pathogen—protecting this crop from this devastating disease. ARS scientists screened more than 1300 wild relatives of wheat in the ARS germplasm collection and discovered critically needed new sources of Ug99 resistance in wheat. ([more information](#))

Determined biodiesel provides 5-to-1 return on fossil energy; new study also found that the new, higher energy return for biodiesel results from three major improvements since the earlier assessment: soybean crushing facilities and biodiesel production plants have become increasingly energy efficient; soybean farmers have adopted energy-saving farm practices, such as minimum tillage; and soybean yields have increased.

ARS scientists developed a sensitive diagnostic method to accurately determine whether or not stem rust symptoms are caused by any of the highly virulent strains of the pathogen in the Ug99 fungus family. If wheat plants suspected of harboring Ug99 stem rust are found in the United States, APHIS will use this diagnostic method to determine whether or not Ug99 is present.

First alfalfa gene index identified and assembled by ARS scientists and several genes associated with regulating lignin and cellulose production were identified thus increasing the value of alfalfa as a bioenergy crop.

2012

Saved the New Orleans French Quarter from destruction by the invasive Formosan subterranean termite using a series of control techniques developed over a period of 15 years. Without this work, the termites would have destroyed all wooden structures in the historic New Orleans French Quarter.

Discovered, developed, and commercialized the first broad spectrum bacterial-toxin insecticide in 50 years. *Chromobacterium*, the source of a new insecticide, is natural, organic, and safe with application for a wide variety of insect pests. This product will provide an important new tool for organic and non-organic food production.

Faster growing Atlantic salmon developed and germplasm released to commercial producers. This could lead to reduced harvest time and increased profitability/sustainability of cold-water marine aquaculture in the United States, providing a quality seafood product to U.S. consumers.

Developed protection for bees from varroa mites. ARS scientists completed breeding of a honey bee with VSH (varroa sensitive hygiene) resistance to the varroa mite, the most devastating parasite of bees. VSH bees detect the odor of bee brood infested with the mite and remove it from the hive. This breakthrough was honored with a Federal Laboratory Consortium Award for Excellence in Technology Transfer. ([more information](#))

Full sequence of citrus rootstock 'Carizzo'—single most important rootstock to the U.S. citrus industry with resistance or tolerance to major citrus diseases, including citrus tristeza virus, foot rot, and citrus greening—completed and [published](#) in publicly-available database.

The USDA's Agricultural Research Service and Oregon State University's PRISM Climate Group jointly developed a new version of the Plant Hardiness Zone Map released in a Geographic Information System (GIS)-based interactive format, updating a useful tool for gardeners and researchers for the first time since 1990 with greater accuracy and detail. ([more information](#))

The U.S. National Arboretum introduced and released a new cherry tree variety in conjunction with National Cherry Blossom Festival Centennial, named for former First Lady Helen Taft to commemorate the 100th anniversary of the Japanese gift of cherry trees. [[more information](#)]

Flavorfest' long mid-season, short-day strawberry released.

2013

Biodiesel provides five-to-one return on fossil energy.

New test for ovine progressive pneumonia (OPP) to help sheep producers detect sheep that are genetically less susceptible to OPP virus and select breeding stock with low-risk genetic factors, thereby reducing the prevalence of the virus in flocks. [[more information](#)]

Scientists develop a new cell line that rapidly and accurately detects highly contagious foot-and-mouth disease virus (FMDV). [[more information](#)]

Researchers at the Plum Island Animal Disease Center design a new patent-pending technology to produce foot-and-mouth disease vaccines safely without the need for virulent virus. [[more information](#)]

ARS scientists developed vaccines to help reduce virulent and virus shed and disease transmission from infected birds to healthy ones. The novel vaccine was shown to protect chickens against infectious laryngotracheitis virus (ILT) and Newcastle disease virus (NDV), two of the most economically important infectious diseases of poultry.

2014

Created a computer-based model of the fluid milk process to lower greenhouse gas emissions.

Development of lateral flow device which provides positive identification of multiple forms of botulinum toxin in less than 20 minutes—suited for rapid, preliminary screening in emergency situations. [\[more information\]](#)

Completion of first ever linkage map for creeping bentgrass which will help in marker-assisted breeding of economically important traits. [\[more information\]](#)

Release of 'Liberty,' a new type of switchgrass specifically designed for bioenergy generation which can yield eight tons of biomass per acre. [\[more information\]](#)

2015

Developed a low-calorie, fruit-based snack bar fortified with micronutrients and fiber.

Hampton, a new edible dry pea variety developed by ARS, resists some of the crop's most costly scourges, including a variety of viruses and fungi. [\[more information\]](#)

Release of OLé, a new Spanish peanut variety that packs high levels of healthful oleic acid. [\[more information\]](#)

Discovery of a relationship between cognitive control and emotional eating behavior in preschool children. [\[more information\]](#)

ARS scientists and collaborators identified salmon genetic markers that indicate resistance to sea lice and developed a panel of genetic markers and transferred that information to salmon farmers for use in a commercial breeding program to increase the efficiency of selective breeding for sea lice resistance in Atlantic salmon.

In response to the first detections of new HPAI viruses (H5N8 and H5N2) in wild waterfowl and captive raptors in the United States in December 2014, ARS refocused its entire team of scientists working on avian influenza research and in record time a rapidly engineered an effective vaccine (rg-H5 vaccine) using reverse genetics technology that matched the H5N2 and H5N8 HPAI viruses that that caused the death of over 45 million chickens and turkeys in the United States and fast-tracked the vaccine to a commercial partner for development and production. [\[more information\]](#)

First African swine fever virus experimental vaccine reported to induce protection when challenged against highly virulent ASFV strain. Plum Island Animal Disease Center scientists engineered a recombinant virus by specifically deleting six genes thought to be associated with virulence. This was the first report demonstrating the role of these genes acting as independent determinants of ASFV virulence.

2016

A new portable, easy-to-use test kit developed by ARS and APHIS scientists identifies red imported fire ants in 10 minutes at inspection stations. [\[more information\]](#)

Scientists develop a sensitive new assay method for detecting the fungus (*Magnaporthe oryzae triticum*) that causes "wheat blast" and can distinguish it from *Fusarium graminearum* [\[more information\]](#)

New raisin grape "Sunpreme" dries naturally on the vine, eliminating the costly pre-harvest step of cutting the canes (branches) to speed up drying. [\[more information\]](#)

ARS and university scientists develop a mobile system for helping dairy farmers make better use of the phosphorus in cow manure. [\[more information\]](#)

Scientists develop a method to rapidly, economically estimate the amount of acrylamide, a potential carcinogen, in white-potato French fries. [\[more information\]](#)

ARS organizes a national bee genebank to help preserve the genetic diversity of honeybees, especially for traits such as resistance to pests or diseases and pollination efficiency. [\[more information\]](#)

Release of crape myrtle, "Big Pink" with southern Florida and Puerto Rico range [\[more information\]](#)

Development of automated intelligent spraying system able to detect the presence, size, shape, and foliage density of trees and apply the optimum amount of pesticide in real time. [\[more information\]](#)

Parasitic wasp *Tetrastichus planipennis* released as biocontrol to combat the emerald ash borer. [\[more information\]](#)

Release of four cold-tolerant faba bean germplasm lines for developing pulse or cover crops that can be rotated with wheat and other cereal grains grown in the Pacific Northwest. [\[more information\]](#)

A new process patented by the Agricultural Research Service uses vegetable oils to remove metals from liquids, solids, and gases. [\[more information\]](#)

New "Heat Stress" smartphone app issues forecasts one to seven days in advance of extreme heat conditions, along with recommended actions that can protect cattle before and during a heat-stress event. [\[more information\]](#)

2017

Researchers develop a new vaccine that protects food animals against both human and animal disease-causing *Salmonella*. [\[more information\]](#)

ARS assists NASA with the launch of SMAP, a new satellite measuring the amount of water in topsoil layers around the world. [\[more information\]](#)

Scientists develop a highly sensitive test that for the first time is able to detect all known Shiga toxin-producing *E. coli* (STEC). [\[more information\]](#)

Eight spinach varieties that have low oxalate levels identified.

The first genome-sequence assembly for the channel catfish. [\[more information\]](#)

ARS scientists develop faster, less costly test to detect staphylococcal enterotoxins in foods. [\[more information\]](#)

ARS-developed moisture-monitoring system could save up to \$22,000 per year in energy costs at a typical peanut-drying station.

Microbiologists develop a new vaccine that protects against different types of *Salmonella* in turkeys and pigs. [\[more information\]](#)

ARS organized "i5k Initiative" aims to sequence and analyze the genomes of at least 5,000 important insect species that are important to both agriculture and biological research.

Release of "Land-Potential Knowledge System" (LandPKS), suite of mobile phone apps to help farmers better monitor their soil and crop conditions to make better decisions about irrigating, weeding, and fertilizing crops. [\[more information\]](#)

ARS scientists develop the "Haney Test," an award-winning soil health tool that major soil testing laboratories are quickly adopting to determine optimal soil fertilizer rates—a revolutionary advancement for fertilizer management.

2018

Scientists unveil genome of small hive beetle (*Aethina tumida Murray*) providing crucial keys that may lead to better, more targeted control methods, to protect honeybees from this major problem. [\[more information\]](#)

Grass-Cast, a new ARS rangeland grazing forecast system, uses historical data about weather and vegetation growth to predict how much grass will be available for livestock grazing during the upcoming summer. [\[more information\]](#)

Release of USDA Branded Food Products Database containing nutrition details on more than 80,000 name-brand prepared and packaged foods available at restaurants and grocery stores. [\[more information\]](#)

Developed improved U.S. domestic rubber production from guayule plant and made breakthroughs in producing passenger tires with guayule rubber. [\[more information\]](#)

Automated sophisticated variable-rate center-pivot irrigation system that targets water to where and when it is needed most save millions of gallons of water.

Developed a game-changing water purification technology to remove nitrogen from wastewater at one-third the cost of existing technologies.

2019

Release of "Keepsake", new midseason, spring-bearing, or short-day strawberry (*Fragaria xananassa Duch ex Rozier*) cultivar. [\[more information\]](#)

The first genome of the invasive Spotted Lanternfly from a single caught-in-the-wild specimen. [\[more information\]](#)

Release of map identifying the areas suitable for establishment of the spotted lanternfly in the United States and other countries. [\[more information\]](#)

Genome of Charleston Gray watermelon sequenced. [\[more information\]](#)

Genome of cultivated peanut sequenced with unprecedented accuracy. [\[more information\]](#)

Developed a self-propelled apple-harvest and in-field-sorting prototype machine.

2020

Release of the first complete genome of the Asian giant hornet. [\[more information\]](#)

Tool developed to help beekeepers decide which colonies to put into cold storage and how to do it most effectively to increase chances of winter survival. [\[more information\]](#)

Release of trio of new 'Joy' peaches—Rich Joy, Liberty Joy, and Crimson Joy—released to enhance the southeastern fresh peach market. [\[more information\]](#)

Dogs specially trained by ARS scientists prove to be efficient way to detect huanglongbing—also known as citrus greening—in citrus orchards. [\[more information\]](#)

A new freeze resistant *Trichinella* species discovered in wolverines by ARS scientists and their colleagues. [\[more information\]](#)

ARS scientists identify a new way to detect the presence of live African Swine Fever Virus that minimizes the need for samples from live animals and provides easier access to veterinary labs that need to diagnose the virus. [\[more information\]](#)

A scent lure designed by ARS scientists to attract Asian giant hornets played a key role in the discovery of the first nest of these invasive insects in the United States. [\[more information\]](#)

ARS scientists release a new Virginia-type peanut, 'Contender', that contains high amounts of oleic fatty acids, which can promote cardiovascular health and extend peanut product shelf life. [\[more information\]](#)

Researchers develop a more sensitive procedure—droplet digital PCR test—to identify the bacteria *Spiroplasma citri* and *Candidatus Liberibacter asiaticus* in citrus using a single test, saving time and money. [\[more information\]](#)

ARS scientists and collaborators develop a rapid, affordable test that can accurately detect the Zika virus by just shining a beam of light for a few seconds on the species of mosquito that spreads it.

Development of a novel RNA interference technology that interrupts the expression of critical whitefly genes.

ARS team contributes to the development of a treatment to desensitize peanut-allergic people. The team was successful in helping develop the very first food (in the form of peanut powder) to be characterized as a pharmaceutical for immunotherapy of peanut allergies. [\[more information\]](#)

FDA approves peanut allergen powder to reduce allergic reactions that occur from an accidental exposure to peanuts.

2021

Release of two new varieties of blackberry: 'Twilight' and 'Hall's Beauty.' [\[more information\]](#)

New fruit-based bar fortified with micronutrients, fiber, and other ingredients that improve gut health based on a unique formula developed by ARS scientists and the Children's Hospital Oakland Research Institute. [\[more information\]](#)

One of ARS's African Swine Fever Virus vaccines has been shown to prevent and effectively protect both European and Asian bred swine against the current circulating Asian strain of the virus. [\[more information\]](#)

A vaccine used in combination with safer pesticides has eradicated multi-pesticide resistant Southern Cattle Ticks (Tropical Cattle Ticks) from a dairy and beef production farm in Yabucoa, Puerto Rico.

[\[more information\]](#)

New self-pollinating almond variety, Yorizane, produces abundant harvest of nuts without pollination by insects. [\[more information\]](#)

African Swine Fever Virus vaccine candidate adapted to grow in a cell line, which means vaccine production will no longer have to rely on live pigs and their fresh cells. [\[more information\]](#)

Researchers at the Agricultural Research Service and US Biologic, Inc., develop an oral solution to an antibiotic alternative that fights against poultry coccidiosis, which costs the poultry industry \$3.5B in annual losses worldwide. [\[more information\]](#)

ARS researchers and collaborators at the University of Idaho's Aquaculture Research Institute develop an improved line of trout germplasm.

Research successfully use tung oil as the starting material for a new additive to improve the performance of diesel fuel.

2022

ARS releases first high-quality genome of the desert locust (*Schistocerca gregaria*)—a species of short-horned grasshopper. [\[more information\]](#)

African Swine Fever virus vaccine passes tests required for regulatory approval. [\[more information\]](#)

Scientists reveal there are two different variants, or genotypes of *Moraxella bovis*, a bacterium known to cause pinkeye in cattle. [\[more information\]](#)

USDA MiCa, USDA Dint and USDA Klondike, first winter pea cultivars specifically developed for human consumption rather than as animal feed released. [\[more information\]](#)

Scientists produce nanobodies in plant cells that block emerging pathogens. [\[more information\]](#)

Release of 'Ho 06-9002' Energycane, a tall perennial grass related to sugarcane, that has high fiber content, excellent regrowth ability, high stalk population, cold tolerance, disease resistance, and excellent biomass yield.

Developed a derivative of urushiol that could help desensitize the skin of individuals susceptible to poison ivy dermatitis.

Developed a unique mobile system that assesses and maps soil carbon to a depth of 30 centimeters (the plow layer) in real time.

ARS scientists and collaborators developed a series of algorithms capable of effectively predicting the prevalence of *Salmonella*.

Researchers develop wax-based oleogels formulations from four different natural edible plant waxes and 12 different kinds of vegetable oils that provide a solid structure to vegetable oils to achieve the desired firmness in spreadable imitation-butter. [\[more information\]](#)

2023

Used gene-editing technology to produce the first calf resistant to the major viral disease bovine viral diarrhea virus. [\[more information\]](#)

Developed natural, washable, antimicrobial cleaning wipes. [\[more information\]](#)

Developed new tests and methods to track COVID infection in wild and domestic animals. [\[more information\]](#)

Discovered metabolic pathway in honeybees with strong connections to winter colony losses.

Began testing efficacy of four vaccine candidates against two strains (H5N1 and H7) of Highly Pathogenic Avian Influenza—a virus usually infecting chickens, turkeys, pheasants, quail, ducks, geese and guinea fowl as well as a wide variety of other birds.