National Program 301
PLANT GENETIC RESOURCES, GENOMICS, AND GENETIC IMPROVEMENT
FY 2007 Annual Report

Introduction

National Program 301 – Plant Genetic Resources, Genomics, and Genetic Improvement – addresses the need to ensure the long-term safety and integrity of our agriculturally valuable genetic resource collections; to identify favorable alleles and create novel methods to deploy them; to exploit new technologies that can enhance traditional methods of genetic improvement; to genetically improve a broad spectrum of major, specialty, and new crops; to increase our knowledge of crop and microbial genomes; and to acquire, analyze, and deliver genetic and informatics resources to the public.

Genetic resources are the foundation of our agricultural future. The Agricultural Research Service (ARS) genebanks contain the sources of resistance to biotic and abiotic stresses and new alleles to improve the quantity and quality of our food, feed, energy, fiber, and ornamental crops. To ensure that those genes are available for research and breeding, ARS must continue to acquire and conserve germplasm that contains them, to develop new screening methods for identifying favorable traits, to ensure that germplasm is distributed where and when it is needed, and to safeguard these collections for future generations.

This National Program is divided into three components:

- *Plant and Microbial Genetic Resource Management* (conserving a broad spectrum of genetic resources and facilitating their use in genetic improvement and scientific research);
- *Crop Informatics, Genomics, and Genetic Analyses* (developing new software tools for analyzing and managing genomic and genetic resource information and delivering the former via databases implemented on up-to-date computer networks); and
- *Genetic Improvement of Crops* (including molecular marker analyses, nucleotide sequencing, gene mapping, comparative and, to a limited extent, functional genomics, plant breeding, and genetic enhancement).

Together, these components are yielding breakthroughs in understanding genome composition, manipulating genetic material, and providing genetically diverse gene pools with sustained and enhanced agricultural value. During fiscal year (FY) 2007 this program produced several important discoveries and advances. Some of these are described below, grouped by program component.

Component 1: Plant and Microbial Genetic Resource Management

Crop genetic diversity conserved and made accessible to breeders and researchers. Genetic resources are critical for continued progress in plant breeding, and are increasingly important for plant genomics research. During fiscal year 2007, the 20-plus genebanks in the ARS National Plant Germplasm System (NPGS) added more than 8,000 new samples — including several hundred new species — to their collections, so that the NPGS now conserves more than 483,000 samples of more than 12,700 plant species. Some of these new samples were acquired via successful collecting trips to 12 nations.

Demand for these samples continues to increase, with more than 150,000 samples distributed during this period.

Assessment of Cocoa Germplasm. To date over 5,000 accessions of cocoa germplasm in Trinidad and Costa Rica have been genotyped, cross-checked with the cooperating institutions and the data placed in international cocoa databases, as well as in Genebank. In addition, interesting sub-collections of wild materials and farmers' selections have been made in Peru. The entire collection of about 600 accessions in French Guiana, comprising both cultivated and wild materials, have also been evaluated and genotyped. Interesting discoveries include the diverse origins of the 'Nacional' cocoa varieties in Ecuador, prized by industry because of their quality traits, as well as detailing the unusual diversity of material found in Nicaragua, which does not completely match the 'Criollo' varieties found in the rest of Mesoamerica, including Mexico.

Component 2: Crop Informatics, Genomics, and Genetic Analyses

Valuable new genetic markers for many crops developed and applied. Plant breeding and genetic resource management, especially for perennial crops, remain painstakingly slow and expense processes. Scientists at ARS genebanks developed and/or applied new genetic markers (Simple Sequence Repeats (SSRs), Single Nucleotide Polymorphisms (SNPs), and nucleotide sequences of key marker genes) for a wide variety of crops, such as tomato, potato, safflower, strawberry, figs, plums, apricots, pecan, lespedeza, cacao, and avocado. These new genetic marker technologies and molecular genotypic information provide rapid and accurate assays of crop genetic variability, yielding critical information for novel crop breeding strategies and for designing efficient and effective genetic resource management programs.

Development of one of the first microarrays for Rosaceous plant species. Methods for gene expression profiling, such as microarrays, have the potential to revolutionize fruit tree genomic research, but no cost-effective microarrays are publicly available for Rosaceous crops such as apple, pear, stone fruits, strawberry, blackberry, and raspberry. A peach microarray of 5,000 DNA fragments was constructed, printed, and validated by ARS scientists at Kearneysville, West Virginia, and the arrays were tested on RNA of developing peach fruit. This study showed that genes active during peach stone hardening were genes for lignin (woody tissue). This work showed that by using microarrays important genes in stonefruit development could be identified and studied, and ultimately manipulated to improve fruit quality.

Identifying genes for iron deficiency chlorosis in soybeans. Iron deficiency chlorosis (IDC) causes millions of dollars in losses in soybean production in the upper Midwest, reducing yields even after the plants seem to have recovered from IDC. ARS researchers applied global gene expression analyses to identify genes whose expression is altered even after plants seem to recover from IDC. This information may provide clues as to

why soybean yield is depressed long after the symptoms of IDC disappear, and may help breeders select soybeans that yield better on IDC-sensitive soils.

Folates (vitamin B9) in potato varieties determined. Folic acid deficiency is one of the most serious global nutrition problems and is the cause of health issues including severe birth defects and an elevated risk of strokes and heart attacks. ARS scientists analyzed folate concentrations during development, storage and in over 80 potato varieties and found over a three-fold range between high and low folic acid-containing varieties. Unlike some other vitamins, folates were stable during long term tuber storage and developmentally occurred at highest concentrations early in tuber development. This is the most extensive analysis of folate ever conducted for any crop and provides information that can be used to develop a high folate potato, which would create new marketing opportunities and further increase the nutritional benefits of potato.

Bioactive compounds in black raspberries and blackberries identified. ARS scientists at Beltsville, Maryland, found that the pigments cyanidin-3-rutinoside and cyanidin-3-glucoside increased the level of peroxides in the human leukemia cells and selectively killed these cells. In contrast, these compounds caused little oxidative stress in normal human peripheral blood mononuclear cells and had very low toxicity toward these cells. This indicates that natural products such as these could exhibit selective pro-oxidant activities in leukemic cells that might be exploited for the development of anti-tumor agents with low toxicity toward normal cells.

Red-fleshed peaches and plums have high anti-oxidant levels. Many fruits have been tested for levels of anti-oxidants, and peaches and plums with yellow flesh were thought to have low levels. ARS scientists at Byron, Georgia, in cooperation with researchers at Texas A&M University, revealed that peach and plum breeding lines with dark red flesh were very high in anthocyanins and other anti-oxidants, in some cases as high as blueberries. These compounds are thought to provide a variety of health benefits to the consumer. Further breeding with these flesh types is warranted to provide high-quality red-fleshed varieties for the grower to produce and deliver to the consumer.

Providing new genetic resources to protect corn from genetic vulnerability. Corn is the most widely grown crop in the United States, but has a narrow genetic base. An expanded genetic base is needed to provide protection to new diseases and pests. ARS scientists at Ithaca, New York; Raleigh, North Carolina; and Columbia, Missouri, have produced over 5,000 diverse maize lines, which are the largest set of mapping lines for complex trait dissection in any species. The researchers have DNA genotyped the lines to produce basic genetic maps with a total of 18 million data points in this effort that was also supported by the National Science Foundation. Developmental and agronomic traits have been determined for the lines in 6 environments. The seed have been increased for deposit with the ARS Maize Genetic Stock Center for use by plant breeders and geneticists. This project will provide unparalleled understanding of the number, location, and positive alleles of genes that can be mined for crop improvement.

Public genetic map of beet constructed. The genetic architecture of beet can be visualized with a genetic map, using molecular markers that are densely spaced and distributed across all beet chromosomes. However, there are limitations of current genetic maps of beet in that only sugar beet has been examined, and few molecular markers are in the public domain. The result is that these maps tend to use different nomenclature for each of the nine chromosomes. A genetic map was constructed using a cross between sugar beet and table beet, using representatives of all types of markers available in the public domain, and named according to a standard nomenclature. A series of easily deployed molecular markers is now available that can be used to orient maps using the same nomenclature, allowing scientists to better compare results from different breeding and genetic materials.

Completion of first apple rootstock genetic map in the United States. There is little or no knowledge of the location of genes that control important apple rootstock traits in the apple genome. To overcome this void, ARS scientists at Geneva, New York, created a genetic map of diverse molecular markers using one of the most successful crosses in the breeding program (Ottawa 3 X Robusta 5), which segregates for several traits including disease resistance, cold hardiness, dwarfing, and precocity. Knowledge of the location and complexity of these traits will enable ARS researchers to streamline their breeding program and permit a more efficient selection and delivery of improved apple rootstocks to the industry.

Gene mapped that is responsible for conversion of tropical sorghums to temperate types for U.S. production. Much potentially valuable sorghum germplasm is of tropical origin and does not successfully flower and produce seed in temperate U.S. growing areas. The development of genetic methods to convert tropical sorghums into photoperiod-insensitive, temperate types would make the tropical germplasm sources available to breeders. ARS scientists at College Station, Texas, in cooperation with scientists at Texas A&M University, have mapped the genes in sorghum that control photoperiod sensitivity and plant height, and genetically characterized the involvement of these genes in conversion of tropical sorghums to temperate types. These discoveries provide the genetic information and methods needed to exploit a wealth of previously unusable sorghum germplasm for development of higher-producing sorghum varieties for U.S. farmers.

New gene for restoring pollen fertility in sunflower. Sunflower hybrids yield more than do non-hybrid plants, but such hybrids are also more complicated to produce. Hybrid seed is produced when pollen from the “male” parent pollinates that of the “female” parent, the latter of which lacks fertile pollen because of a cytoplasmic male sterility (cms) gene. Availability of a diversity of cms genes and other genes that restore pollen fertility is important, so as to avoid genetic vulnerability, such as that responsible for the 1970 southern corn leaf blight epidemic. ARS scientists in Fargo, North Dakota, discovered a new fertility restoration gene from wild sunflowers that, paired with a new

cms gene discovered by Chinese collaborators from another wild sunflower, provides an alternate genetic source for hybrid sunflower production, should the current commercial cms gene cause susceptibility to diseases, pests, etc.

Component 3. Genetic Improvement of Crops

The predictive value of taxonomy and ecogeography for germplasm assessment tested. ARS scientists at Madison, Wisconsin, tested the ability of taxonomy and ecogeography to predict the presence of a valuable trait (host plant resistance to white mold of potatoes) in groups of germplasm accessions. No consistent association was observed between white mold resistance and taxonomy, place of collection, or environmental factors. Consequently, taxonomic relationships and ecogeographic data cannot be reliably used to predict where additional sources of white mold resistance genes will be found. These results highlight the need for conducting additional tests of predictive value for other traits, and in other crops.

Chromosomal regions identified that control seed protein concentration in soybean. Increasing protein concentration will help to keep U.S. soybeans competitive in the world market and provide varieties for specialty markets. Understanding the genetic control of seed protein may help to increase protein concentration without reducing seed yield. ARS researchers in Urbana, Illinois, identified chromosomal regions controlling seed protein concentration using three populations of inbred lines with different exotic sources of high protein in each population. The sources of high protein ranged from 48 to 52 percent protein and were from Japan, Russia, and South Korea. The researchers identified four chromosomal regions previously reported to affect protein concentration, and found one region that increased oil with the positive allele coming from the high-protein parent. This information will be useful for soybean breeders in developing new varieties with increased protein concentration and for scientists interested in the genetic control on seed composition.

More effective genetic marker for nematode resistance in peanut. The root-knot nematode causes serious yield losses in peanut. Traditional means of screening peanut genetic resources for host-plant resistance to this nematode, and for selecting breeding lines with such resistance, are tedious and expensive. ARS researchers in Tifton, Georgia, discovered a peanut molecular genetic marker that is highly correlated with host-plant resistance to root-knot nematode, is economical to use, and can be assayed by rapid DNA analytical methods. Peanut breeders can use this marker to accelerate the development of peanut cultivars with nematode resistance combined with other important agronomic traits.

More effective genetic markers for identifying soybean cultivars. For decades, morphological, physiological, color, and biochemical traits have been used to identify soybean cultivars, but some new cultivars cannot be distinguished by the preceding traits.

ARS researchers at Beltsville, Maryland, identified a set of 23 single-nucleotide polymorphism (SNP) DNA markers, located on 19 of the 20 soybean chromosomes, which rapidly and relatively inexpensively distinguish soybean cultivars. This new set of genetic markers may set future standards for soybean cultivar identification.

Differences found in fruit drying rates of raisin grapes. Labor has become limited and cost prohibitive for hand harvesting of raisin grapes. Early ripening raisin grape varieties that dry quickly are needed to facilitate mechanical harvest and replace Thompson Seedless, the standard raisin variety that ripens late and dries slowly. ARS scientists at Parlier, California, determined that berry size and sugar content significantly affected drying rate. Summer Muscat had the fastest drying rate compared to other varieties tested. Even when the waxy layer was removed, Summer Muscat dried quicker than Thompson Seedless, indicating that skin or cuticle characteristics influence the drying rates in raisin grape varieties. This information will be helpful to breeders in developing new varieties with faster drying rates that are suitable for mechanical harvest.

New rootstock for peach. The release of Guardian peach rootstock in 1993 was a turning point in the management of peach tree short life (PTSL), which at that time was the leading cause of premature peach tree mortality in the southeastern United States. However, Guardian's susceptibility to Armillaria root rot, the number one problem, was a significant deficiency. In the absence of any alternative chemical or biological management program, the development of an Armillaria-resistant rootstock remained a pressing need. The release of Sharpe rootstock by ARS scientists at Byron, Georgia, marks the introduction of the first Armillaria (*A. tabescens*) resistant rootstock for peach in the United States. Additionally, Sharpe rootstock displays resistance to PTSL and root-knot nematodes comparable, if not superior, to that of Guardian.

Rice genes and molecular markers identified for disease resistance and milling qualities. The most damaging and prevalent rice disease in the southern United States is rice blast. ARS researchers at Stuttgart, Arkansas, have identified resistance genes by screening the U.S. rice germplasm collection. Rice lines with resistance to all strains of blast found in the United States have been identified. Genes for resistance to rice sheath blight have also been identified. At Beaumont, Texas, ARS researchers have developed genetic markers associated with two significant milling yield component traits, grain chalkiness and greenness. The new genes and markers can be exploited by rice breeders to develop new varieties with enhanced disease protection and higher milling rice yield.

Development of cocoa DNA markers associated with disease resistance. Disease is the primary cause of economic loss to cocoa farmers worldwide. From a strategic viewpoint, frosty pod, *Moniliophthora roreri*, is the most dangerous if it were to spread from the Western Hemisphere to Africa or Southeast Asia and the Pacific. Witches broom disease is a significant problem in much of South America and especially significant in Brazil (*Moniliophthora perniciosa)*, and Black pod disease (*Phytophthora spp.*) is a worldwide problem. The approach has been to utilize various molecular markers to identify the loci

of disease resistance and subsequently apply these in a marker-assisted worldwide breeding program to improve the genetic basis of cocoa production. Four candidate genes have been associated with black pod disease. If an appropriate series of selections can be made, the candidate germplasm will be placed in quarantine in the United Kingdom and released in West Africa within 2 years. Also, in collaboration with CATIE, Costa Rica, six genotypes identified to be resistant to frosty pod have been released in Central America for field trial and evaluation. Through an agreement with the International Institute for Tropical Agriculture (IITA), Nigeria, a system for evaluating genetic diversity and establishing trials for resistant material, has been established in West Africa.

Reniform-resistant upland cotton germplasm developed. Upland cottons are the primary cotton types grown in the United States and are highly susceptible to damage by the reniform nematode. ARS scientists in College Station, Texas, in cooperation with scientists at Texas A&M University, used modern cross-breeding techniques to develop nematode-resistant cotton germplasm, with the genetic resistance being derived from *Gossypium longicalyx*. The new germplasm exhibits very high levels of resistance to the reniform nematode, and will be made available to cotton breeders for incorporation into breeding programs. This accomplishment is important because it will facilitate the development of commercial reniform-resistant cotton cultivars that will allow farmers to more profitably grow cotton in nematode-infested areas, some of which are so seriously infested that cotton cannot be successfully grown at present. Economic impact on the U.S. cotton industry will be tens of millions of dollars annually.

Crown gall resistant walnut germplasm. The most widely used root stock in the walnut industry is highly susceptible to crown gall disease which causes significant yield loss and reduction in tree life and vigor. ARS scientists in Davis, California, have identified several *Juglans* species that exhibit significant levels of resistance to *A. tumefaciens* under greenhouse conditions using artificial inoculation techniques. Identification of crown gall resistant walnut germplasm for use in the juglans rootstock breeding program will have a tremendous impact on the walnut industry in California.

Yield-enhancing chromosomal regions identified in soybeans. Domestic producers of soybean, the most important oilseed crop in the United States, are currently under pressure from strong international competition, consequently yield enhancement is critical for profitability of domestic production. ARS researchers at Urbana, Illinois, used highly diverse soybean materials to identify more than a dozen chromosomal regions that enhance yield. Most of the yield-enhancing genetic material originated from non-U.S. germplasm sources. Identifying the chromosomal regions affecting yield is an important step for locating the specific genes responsible for soybean yield enhancement.

Release of citrus rootstocks resistant to Diaprepes root weevil. A complex disease and insect problem, the Phytophthora-Diaprepes disease complex (PDC), has destroyed thousands of acres of Florida citrus. Two promising new hybrid citrus rootstocks with

field tolerance to PDC and good fruit productivity were developed by the USDA citrus breeding program and released in 2007 for commercial use. These new rootstocks exhibit dramatic differences in their effects on fruit tree size, and thereby provide a wide range of management options for commercial producers. The rootstocks, US-802 and US-897, fill much-needed niches for vigorous and dwarfing rootstocks, respectively, with field tolerance to PDC. There is large commercial interest in these new citrus rootstocks in Florida.

Low-phytate barley varieties protect the environment. Enhancing phosphorus utilization in livestock production is critically important to both animal productivity and to managing the environmental impact of agricultural production. A barley variety that has high-available phosphorous and low-phytate was developed by ARS researchers at Aberdeen, Idaho. Use of this new cultivar as a feed grain will enhance animal productivity, while reducing phosphorus in animal waste. The scientists have also demonstrated in growing chicks that zinc nutrition was substantially enhanced following consumption of phytate-free barley.

Root-knot nematode resistant cotton germplasm released. Cotton cultivars with host-plant resistance would provide the ideal means for controlling root-knot nematode, a major pest of cotton. But breeders require germplasm incorporating not only host-plant resistance, but also superior agronomic and fiber qualities. ARS researchers at Starkville, Mississippi, released six germplasm lines combining high levels of resistance to root-knot nematode with good agronomic and fiber properties. Most of the major cotton seed breeding companies have already requested and received seed of these lines for use in their breeding programs.

Release of high-fiber sugarcane varieties for application to the biofuel efforts. With an ever-increasing interest in sugarcane as an energy crop, sugarcane breeders around the world are being called on to develop so-called energy cane cultivars to be used primarily as a fuel source while continuing to genetically improve sugarcane primarily as a sucrose source. Commercially-released high-fiber canes for energy crop purposes have not heretofore been available in the United States. Together with the Louisiana State University AgCenter, St. Gabriel, Louisiana, ARS scientists in Houma, Louisiana, released three high-fiber sugarcane varieties that excel in total solids accumulation. This will allow an emerging energy crop industry to have a choice of varieties – namely a very high-fiber, low-sugar variety; a high-fiber, moderate-sugar variety; and a traditional moderate-fiber, high-sucrose sugarcane – available to satisfy individual interests and regional constraints.

Dutch Elm disease-tolerant American elms released. The accidental introduction of Dutch elm disease has practically eliminated American elm from urban landscapes in the eastern United States. Interest in disease-tolerant American elms has increased with the release of ARS selections from the U.S. National Arboretum. An additional three clones

of American elm tolerant to Dutch elm disease have been identified for further evaluation, including two intraspecific hybrids from the breeding program.

New pepper germplasm with unique culinary/ornamental characteristics released. Novel peppers have the highest per unit value of any pepper product and have become a profitable crop for greenhouse pot plant and an innovative way for farmers to produce a high-value specialty crop. Utilizing the rich genetic diversity available in pepper landraces and related species, ARS scientists in Beltsville, Maryland, with two industry partners under a Cooperative Research and Development Agreement, developed new pepper cultivars with novel fruit, foliage, and plant growth habit. Four selections with unique culinary/ornamental characters have been released by ARS and submitted for patent protection.

Increased carotenoid content of niche market potato 'Peter Wilcox'. 'Peter Wilcox', a dark purple-skinned, yellow-fleshed potato variety was developed by ARS researchers in Beltsville, Maryland, with university collaborators in North Carolina, New Jersey, New York, Maine, Pennsylvania, and Florida, as a fresh-market, specialty potato. Carotenoid content of Peter Wilcox was more than 15 percent greater than 'Yukon Gold', the current yellow-flesh standard variety in the United States. This new variety provides growers and consumers with a unique combination of skin and flesh colors for niche markets.

First pinto beans with partial resistance to white mold released to public. Sclerotinia white mold disease results in $10 million to $15 million in lost revenue to pinto bean growers annually. Currently, no commercial cultivars are resistant to white mold, and the application of foliar fungicides is cost prohibitive. ARS researchers in Prosser, Washington, identified 34 pinto bean germplasm lines with resistance to white mold disease after screening more than 500 accessions in collaboration with researchers from Michigan State University and North Dakota State University and support from the ARS Sclerotinia Initiative. Together, they bred the first pinto beans with partial resistance to white mold disease. Two high-yielding pinto bean lines were released with the first partial resistance to Sclerotinia. The lines have been distributed to bean breeders across the United States for use in reducing the susceptibility of pinto bean cultivars to white mold.

New wheat varieties and germplasm provide disease protection and reduce production risk. Fungal and viral diseases can cause major losses for small grain growers and reduce supplies for grain millers and bakers. ARS plant breeding teams have developed new varieties with genetic protection to devastating diseases. ARS researchers at Lincoln, Nebraska, and at the University of Nebraska released the first hard winter wheat with resistance to wheat streak mosaic virus. A club wheat with enhanced stripe rust and powdery mildew resistance, along with excellent end-use quality was developed by researchers at Pullman, Washington and Washington State University. In Fargo, North Dakota, ARS researchers identified a new source of resistance in wild emmer wheat to Fusarium head blight, a devastating disease of wheat and durum. These new varieties

and germplasm will not only reduce economic losses for producers but also safeguard the environment from the need for chemical control of the pathogens.

New soybean cultivar resistant to soybean cyst nematode. Soybean cyst nematode significantly decreases soybean yield throughout the United States, causing many millions of dollars of losses. ARS researchers in Stoneville, Mississippi, released a new soybean germplasm line with an early maturity and strong resistance to prevalent soybean cyst nematode races for which most currently-marketed soybean varieties lack resistance. Public and private sector breeders throughout the United States have already requested seeds of this new germplasm for their breeding programs.

'HoneySweet', a genetically engineered Plum Pox virus-resistant plum, deregulated by APHIS. Plum pox virus is an exotic invasive virus pathogen of stone fruit species and has been detected in three states (Pennsylvania, New York, and Michigan). To protect commercial plum production, a genetically engineered resistant plum – 'HoneySweet' – was produced by ARS scientists at Kearneysville, West Virginia. In order for this plum to be commercialized, deregulation by USDA Animal and Plant Health Inspection Service (APHIS), the FDA, and EPA is required. So far, the plum has been deregulated by APHIS, making it the first deregulation of a temperate tree fruit by APHIS. This is an important step in the process that will make this resistant plum available to growers and provide resistant plum germplasm for breeding programs.

Alternative pear cultivars for Pacific coast growers. The lack of diversity in current commercially grown pear cultivars limits opportunities to capitalize on specialty markets and consumer demand for new high quality fruit. Working with collaborators in California and Oregon, ARS scientists at Kearneysville, West Virginia, developed cultivars, 'Blake's Pride' and 'Sunrise', and an unnamed selection that were evaluated and rated very high in consumer preference tests. The unnamed selection, which also has quality traits of benefit to growers and packers, will be submitted for cultivar release. The new cultivars have the potential to increase consumption of pears. In addition, the newest selection will provide growers and packers with an attractive new cultivar which can be stored for long periods and handled with minimal damage.

New red raspberry cultivars developed. In an ongoing collaborative project with Agriculture and Agri-Foods Canada and Washington State University, ARS scientists at Corvallis, Oregon, developed new red raspberry cultivars 'Saanich' and 'Cascade Bounty'. Saanich produces a very high yield of medium-sized, firm, sweet fruit suited to machine harvesting and that can be individually quick frozen very well. Saanich is well adapted for the processing and fresh markets and is resistant to the common strain of the North American raspberry aphid. Cascade Bounty has high levels of root rot tolerance and high yields of mid- to late-season fruit on sites with severe root rot infestations. The fruit is tart, bright-colored, medium size, and rounded in shape and is recommended for machine harvesting for processing uses. Over 470,000 plants of Saanich and Cascade

Bounty have already been sold and planted by commercial red raspberry growers in the Pacific Northwest.

New pecan cultivar, Lakota, released. Nut production in pecans requires several-to-many years from tree planting to commercial nut production. Breeding efforts to develop improved cultivars is a slow, but necessary, process if new cultivars resistant to pests and diseases, with superior nut yield and quality traits, are to be made available to producers. ARS scientists at College Station, Texas, in cooperation with scientists at Kansas State University, developed this clone and determined it merited naming and release as a new USDA cultivar. This is an important accomplishment because it provides growers with a new and productive pecan cultivar that fills a market niche and should increase production efficiency and grower profits. Lakota also has disease resistance characteristics that will lessen the need for pesticide applications which are expensive to the grower and potentially harmful to the environment.

Release of the new fresh market muscadine grape cultivar 'Eudora'. A new fresh-market muscadine grape cultivar, 'Eudora' was released by ARS scientists at Poplarville, Mississippi, to nurserymen for propagation and sale to growers in 2007. Eudora is productive and produces large flavorful berries possessing high concentrations of phenolic compounds associated with the prevention of coronary disease and cancer.

Two new peach varieties released. Current peach varieties that ripen in the late season were no longer competitive in the market. Augustprince and Early Augustprince, two new varities developed by ARS scientists at Byron, Georgia, have fruit that are firmer and more attractive than that of Cresthaven and Sunprince, which they can replace. These new releases provide the industry with long-needed, more reliable alternatives for these older peach varieties.

A new moderate-chill peach variety released. Current commercial variety ripening in this season, June Gold, has not set adequate crops in recent low chill years and no longer provides sufficient fruit quality (excessive split pits and low soluble solids) and appearance for current market needs. Gulfcrimson, a new variety developed by ARS scientists at Byron, Georgia, is significantly firmer than June Gold and provides a substantial improvement in fruit quality (virtually no split pits and higher soluble solids) and appearance in combination with a markedly better cropping record.