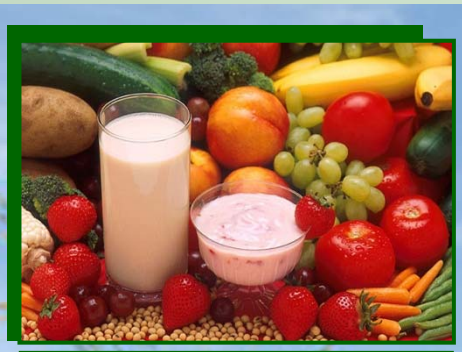
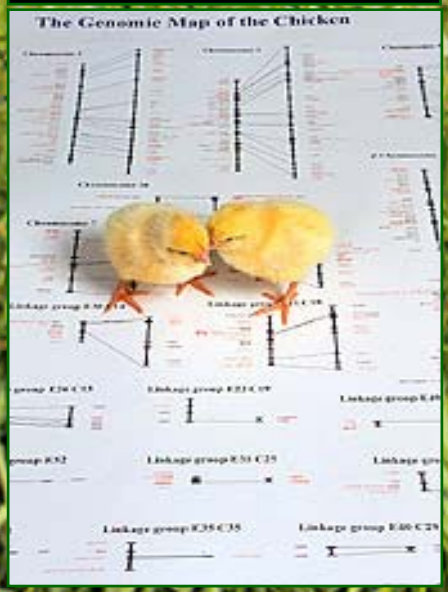
U.S. Department of Agriculture
Annual Reporting on Technology Transfer
FY 2009





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U.S. Department of Agriculture (USDA)

Annual Reporting on Agency Technology Transfer[1]

This report covers technology transfer activities and metrics for the Agricultural Research Service (ARS), the Animal Plant Health Inspection Service's Wildlife Services (APHIS-WS), and the Forest Service (FS). This report includes tabular metrics of inventions, licenses, and Cooperative Research and Development Agreements for ARS, APHIS-WS, and FS.

Agricultural Research Service (ARS)

Mission Statement

ARS conducts research to develop and transfer solutions to agricultural problems of high national priority and provides information access and dissemination to:

- ensure high-quality, safe food, and other agricultural products;
- assess the nutritional needs of Americans;
- sustain a competitive agricultural economy;
- enhance U.S. natural resources and the environment; and
- provide economic opportunities for rural citizens, communities, and society as a whole.

Structure of Research

ARS is USDA's principal intramural scientific research agency. Agency goals are to find solutions to agricultural problems that affect Americans every day, from field to table, such as (a) protecting crops and livestock from pests and diseases, (b) improving the quality and safety of agricultural products, (c) determining the best nutrition for people from infancy to old age, (d) sustaining our soil and other natural resources, (e) ensuring profitability for farmers and processors, and (f) keeping costs down for consumers.

ARS employs over 8,000 people; approximately 2,100 permanent full-time scientists and approximately 3,300 technical and support staffs conduct research in projects funded by Congressional appropriations at more than 100 locations. Research projects are grouped into 22 National Programs under the four broad pillars of Animal Production and Protection; Nutrition, Food Safety and Quality; Natural Resources and Sustainable Agricultural Systems; and Crop Production and Protection. The Office of National Programs in Beltsville, MD coordinates the scope and objectives of Agency research projects, while eight Area Directors implement research projects at the locations in their geographic areas. All research projects undergo a mandatory 5-year peer review and assessment cycle to ensure accountability in meeting the changing needs of customers and stakeholders; the Office of Scientific Quality Review convenes panels of industry and university scientists to review research progress, evaluate the 5-year research proposals, and evaluate the scientific qualifications and abilities of agency researchers. The process is structured to ensure quality, impact, and research relevance.

[1] Prepared by the Agricultural Research Service, Office of Technology Transfer, in response to the requirements identified for the annual "agency report on utilization" by 15 USC Sec. 3710 (f)(2).

Animal Plant Health Inspection Service (APHIS) – Wildlife Services (WS)

Beginning in FY 2006, the ARS Office of Technology Transfer expanded its services to APHIS-WS. APHIS builds and maintains a world-class system that safeguards the health of animals, plants, and ecosystems in the United States. It fosters safe agricultural trade world-wide, resulting in abundant and affordable agricultural products for U.S. consumers and the rest of the World. APHIS is responsible for administering the Animal Welfare Act, Plant Protection Act, Animal Heath Protection Act, Public Health Security and Bioterrorism Preparedness Act, and the Pet Evacuation and Transportation Standards Act. These Acts have refined and expanded the scope of the APHIS mission.

Mission Statement

APHIS-WS provides Federal leadership and expertise to resolve wildlife conflicts and creates a balance that allows people and wildlife to coexist peacefully. Current program activities include threatened and endangered species conservation, the protection of public health and safety, wildlife disease surveillance and monitoring, a nationally coordinated research effort, and other activities and programs.

Structure of Research

APHIS-WS's National Wildlife Research Center (NWRC) operates as the program's research arm and conducts research to resolve human-wildlife conflicts, while maintaining the quality of the environment shared with wildlife. NWRC is headquartered in Ft. Collins, CO and maintains eight field stations across the country. NWRC employs 174 professional scientists. NWRC's animal facilities and laboratories include extensive behavioral, analytical chemistry, immunology, physiology, and microbiology support for working with vaccines, wildlife contraceptives, pesticides, and repellent registrations.

Forest Service (FS)

Mission Statement

The mission of FS is to sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations. Established in 1905, FS is an agency of the U.S. Department of Agriculture that directly manages 193 million acres of public land in national forests and grasslands, and works with state forestry agencies and other partners to assist in managing 491 million acres of state and private forest lands. Gifford Pinchot, the first Chief of the Forest Service, summed up the mission of the Forest Service—"to provide the greatest amount of good for the greatest amount of people in the long run."

Structure of Research

FS's research and development (R&D) mission area develops and delivers the scientific information and technology needed to manage, protect, use, and sustain the natural resources of forests and rangelands. Research is conducted by over 550 scientists and several hundred technical and support staff through a network of forest and range experiment stations, the International Institute for Tropical Forestry, and the Forest Products Laboratory. FS R&D is conducted at a total of 67 sites throughout the United States and in Puerto Rico.

The research program is organized among seven Strategic Program Areas: wildland fire and fuels; resource management and use; wildlife and fish; recreation; water and air; inventory monitoring and analysis; and invasive species. FS R&D maintains a vital network of 81 experimental forests and ranges, 29 of which were established in the 1930s. Long term records from some of these forests can provide unprecedented insights into global climate change, watershed function, disturbance recovery and many other areas. FS R&D is currently pursuing special emphasis in climate change, biomass to energy, watershed restoration, urban natural resource stewardship, and nanotechnology. FS R&D seeks to achieve excellence in conducting high-quality research on relevant topics in natural resource sciences.

I. ARS Approach and Plans for Technology Transfer

Technology Transfer Principles, Modes, and Plans

ARS has been delegated authority by the Secretary of Agriculture to administer the patent program for ARS, and the technology licensing program for all intramural research conducted by USDA. Thus, ARS's Office of Technology Transfer (OTT) is assigned the responsibility for protecting intellectual property (IP), developing strategic partnerships with outside organizations, and performing other activities that effectively transfer ARS research outcomes and technologies to the marketplace. The Patent Section of the USDA Office of General Counsel provides legal guidance to OTT.

ARS-OTT is centralized in policy and approval procedures, but maintains field offices to provide one-on-one customer service to ARS researchers. To facilitate technology transfer, OTT is organized into five sections. The *Administrative/Headquarters Section* conducts day-to-day operations, coordinates technology transfer policy development, and executes licenses and Cooperative Research and Development Agreements (CRADAs). The *Patent Section* provides strategic guidance to scientists in protecting IP, coordinates invention reports, prepares and prosecutes patent applications, and oversees any patent applications prepared by contract law firms for foreign patent rights. The *Licensing Section* negotiates licenses for IP developed by USDA scientists and monitors license performance. The *Marketing Section* develops, implements, and coordinates marketing strategies to facilitate available information to support technology transfer. ARS has seven *Technology Transfer Coordinators* (TTCs) strategically stationed across the United States who are responsible for facilitating the development and transfer of USDA technologies. They serve as liaisons with scientists, ARS managers, university partners, and the private sector. They also negotiate CRADAs and other technology transfer agreements. The TTC for the Northern Plains Area, located in Ft. Collins, CO, also serves as the

principal contact and liaison for scientists conducting research within APHIS-WS. The principal contact for technology transfer within the FS is the Patent Advisor located at the Forest Products Laboratory in Madison, WI.

Technology transfer is accomplished through many mechanisms, such as:

- developing written information for customers and stakeholders, including scientific publications, publications in trade journals, and reports to stakeholders;
- releasing plant germplasm to the public;
- transferring research materials to scientists outside of ARS;
- entering into formal partnership agreements, such as CRADAs, and other cooperative agreements;
- delivering specific research results to regulatory agencies to support their actions;
- licensing IP (patents, Plant Variety Protections Certificates, and biological materials);
- participating in meetings with industry organizations and universities, workshops and field days; and
- distributing information to the public via the ARS Information Staff, the National Agricultural Library, and other sources.

Because the ARS mission is to transfer technologies for broad public use by the most effective mechanism, ARS pursues patents and licensing principally when this facilitates technology transfer to the marketplace. This is usually the case when complementary investment by the private sector is necessary to commercialize a product, and patent protection is required to protect this investment.

ARS holds periodic patent committee meetings to review invention disclosures and make recommendations to the Assistant Administrator for Technology Transfer on whether a patent is necessary to facilitate technology transfer.

For APHIS-WS, invention disclosures are evaluated within ARS patent review committees that are expanded to include three APHIS-WS members. ARS committee recommendations for APHIS-WS inventions are made to the Director of the APHIS National Wildlife Research Center in Ft. Collins. ARS Patent Advisors prepare, file, and prosecute ARS patent applications and WS inventions on behalf of APHIS, and coordinate patent application filings in other countries through a contractor.

Strengthening Performance Metrics

Meaningful performance metrics in technology transfer are often difficult for research agencies. For example, for ARS, successful outcomes may include improved agricultural practices, scientific information that enhances U.S. competitiveness, increased awareness about pathogens to help prevent human and animal diseases, or findings that help corporations and universities make informed decisions in allocating their research resources.

ARS is continuing to work on defining better metrics for technology transfer. In FY 2007, a graduate intern (economist) in OTT surveyed CRADA partners to help assess the impact of the

CRADA program on individual small business partners, and to obtain feedback from these customers about the delivery of OTT services. The survey results were used by OTT management in FY 2008-2009 in fine-tuning research partnerships.

OTT has patent and licensing database modules within the Agricultural Research Information System (ARIS) to allow portfolio development of "technology families." The invention disclosure process for determining patent protection includes a module for "Utility Patents," a module for "Plant Materials," and a module for "Biological Materials." The latter is designed for tracking information where private-sector licensing is requested for those materials. This allows a refined process for documenting research outcomes, and these are reflected in the tabular data contained in this report. The Plant Materials module provides a way to review new plant varieties to determine the merits of protecting and licensing intellectual property, versus making a public release. This module allows OTT to track research outcomes and document private-sector adoption. Collectively, this improved infrastructure enables OTT to track technology transfer arising from protectable IP, plant germplasm and biological materials. Because licensing activities require detailed information on USDA patents, the ARIS database now includes all inventions arising from FS and APHIS-WS.

OTT uses a different ARIS module for the TTCs that capture information about potential and executed Confidentiality Agreements, Material Transfer Agreements, and CRADAs. All TTC activities on this database are linked to ARS National Program (NP) projects so annual metrics can be obtained for each NP and be included in annual reports for the Government Performance and Results Act, the Project Assessment Rating Tool, and the Budget Performance Integration. OTT prepares monthly reports for senior ARS management summarizing the activities tracked in this database. This allows Area Directors and National Program Leaders to monitor accomplishments and receive early notice of anticipated future technology transfer activities.

New Initiatives to Enhance Technology Transfer

Metrics from the ARS licensing program illustrate strong emphasis on partnerships with universities and small businesses. Of 301 licenses in force, 39% are with universities to consolidate rights of co-owners, U.S. government and universities. This enables subsequent licensing of all U.S. rights to private sector companies to commercialize the inventions. Thirty-five percent of licenses are with small businesses, and 18% with large businesses, including foreign multinationals with major U.S. presence. Of 25 licenses executed in FY 2009, 40% were with universities and 40% were with small businesses; two were startups based on ARS technologies.

It is clear that our nation is facing grave emerging issues of food security, water availability and quality, sustainable biofuels and alternative energy development, increased global competition, and economic instability. Traditionally, innovation and small business development have been critical to the nation's global competitiveness and in achieving sustainable local/regional economic development. The global economic downturn of 2008 and 2009 has furthered highlighted the urgency to focus on innovation, competitiveness, and job creation. Thus, to help meet these challenges and enhance partnering with small businesses, ARS initiated an Agricultural Technology Innovation Partnership (ATIP) program to facilitate adoption of ARS

research outcomes by private-sector companies for commercial production of goods and services.

Key to this initiative is the use of Partnership Intermediary Agreements (PIA) with technology-based economic development entities. This new instrument to ARS was developed in 2007 to facilitate partnerships with private-sector companies through an economic development intermediary. Intermediaries are strategically chosen by geographic region and for their ability to serve small businesses by providing assets complementary to ARS's research and innovation capacities. A strategic network of eight economic development PIAs across the United States, each anchored regionally to one of the eight ARS Areas, would increase opportunities for businesses – through the Intermediary – to gain access to the 2,100 scientists conducting research at over 100 ARS locations, and strengthen partnerships with our university researchers. Intermediaries facilitate business development and competitiveness by helping ARS identify companies to license ARS innovations. They also assist small businesses whose research needs can be matched to the expertise of ARS scientists conducting research addressing high-priority agricultural issues. Businesses identified and assisted by the ATIP Partner (intermediary) – who subsequently partner with ARS through licensing or by establishing a CRADA – are designated as ATIP affiliates.

In the closing days of FY 2007, ARS executed it first Partnership Intermediary Agreement with the Maryland Technology Development Corporation (TEDCO). It is significant that within the first 18 months of this agreement with TEDCO, seven ATIP Affiliates were established – five with some funds provided by TEDCO (two more pending). One of these affiliates, a Maryland start-up business, licensed an ARS technology from the Southern Regional Research Center (SRRC) in New Orleans, and established a CRADA in FY 2009 with SRRC scientists. This partnership resulted in product sales in less than one year.

In FY 2009, ARS entered into two additional PIAs with the Mississippi Technology Alliance (MTA) and the Wisconsin Security Research Consortium of the Wisconsin Technology Council (WSRC/WTC). A fourth PIA with the National Association of Seed and Venture Funds (NASVF) was executed in early FY 2010. This Partner differs from the others by having members in 42 states. NASVF's role in ATIP is to provide the ATIP Partners access to seed and venture funds arising from NASVF members, to assist Partners in regional showcase and entrepreneurial training events, and to assist ATIP in documenting economic impact of ARS technologies adopted by the private sector and others.

In FY 2009, MTA reviewed 27 technologies within the ARS portfolio for commercialization potential. From that review, seven technologies were selected for further evaluation by specific commercial partners to determine the appropriate and strategic path to licensing or CRADA. In addition, four ARS projects were as selected for MTA's Center for Innovation and Entrepreneurship to follow-on engagements with MTA clients.

In FY 2009, TEDCO and ARS co-hosted a Green Technologies Showcase highlighting technologies and research capacities of scientists across the agency. From this event, several new technology transfer activities occurred:

- ARS scientists in different national program areas of research formed new interdisciplinary teams that increased their both their research capacity and impact. Three of these teams found private-sector partners and have set-up collaborative research projects.

- New CRADAs were established that create industry/ARS research teams to develop new technologies to address specific industry problems, instead of the conventional model of focusing on the transfer of technologies already created by ARS.

- The showcase launched the first orchestrated tabletop display and brochures of the pilot plans housed in the four ARS regional research centers. This highlighted their various research capacities and facilities, as well as contrasted their differences. Brochures were developed for each Pilot Plant for use in other showcases that will be co-hosted by ATIP Partners.

- These regionally-convened ARS national showcases represent a new model for ARS, Each will be themed differently, and are expected to broaden and strengthen ARS research collaborations to more effectively move ARS technologies and research outcomes toward commercialization. Two showcases are planned for FY 2010: one on geospatial research to be hosted by MTA, and the other on urban agriculture to be hosted by WSRC/WTC.

ARS continues to expand and improve its technology transfer activities in other ways. These include the following activities that reflect continued or new initiatives for FY 2009:

- Tradeshow attendance continues to be a part of ARS-OTT's marketing strategy. These shows allow the agency to diversify and reach new target customers. OTT's goal is to continue to have an ARS presence at major industry conferences to present technologies available for licensing and research partnering opportunities of interest to industry. Tradeshows are an important element of the total marketing program used to communicate what ARS has to offer in terms of technologies available for licensing, and research capacities to solve problems of agricultural industries. Shows are selected, in part, based on the types and number of technologies in a particular area needing private-sector partners for commercialization.

- The ARS-OTT Technology Alerts continue to expand its membership in 2009. Strategic marketing is structured to focus on providing specific targeted information to agency customers. The Marketing Staff continues to fine-tune its Technology Alerts list by expanding list options.

- In FY 2010, the OTT Marketing will add three new Web-based modules to provide updates and information to customers and stakeholders. Two of the new modules will provide slide shows of ARS downstream outcomes and licensed products, while the third will provide enhanced search abilities through a new patent portfolio of available technologies. These new modules are set for release in early FY 2010. The new list will highlight technologies from all ARS program areas.

- ARS-OTT, working with the governing body of the International Treaty on Plant Genetic Resources for Food and Agriculture, developed a Standard Material Transfer Agreement (SMTA) for the transfer of wild plant germplasm. This SMTA allows researchers throughout the world access to germplasm from member countries, including germplasm from the International Agricultural Research Centers of the Consultative Group on International Agricultural Research (CGIAR). Most of the world's wild plant germplasm is held by CGIAR.

- Given the increased emphasis during FY 2009 on food security and invasive species ARS is redefining and expanding research on crop protection and quarantine. The new National Program, Crop Protection and Quarantine (304), brings emphasis to this research topic by realigning and combining components of other National Programs and planning new research. OTT and the National Program Leaders from the Office of National Programs conducted a technology transfer workshop in FY 2009 specifically addressing the technology transfer processes necessary to enhance crop protection and quarantine research outcomes.

- In order to address the USDA's *Know Your Farmer, Know Your Food Initiative*, the Midwest Area (MWA), Beltsville Area (BA), and the North Atlantic Area (NAA) signed a Non-Funded Cooperative Agreement (NFCA) with the Redevelopment Authority (RDA) of the City of Philadelphia. By pooling their strengths and collaborating closely, ARS and RDA seek to develop a team to address issues in urban agriculture. This team can address a range of issues, including soil management and reclamation, industrial and municipal solid waste reuse and composting, intensive greenhouse management, wastewater treatment and reuse, organic food production, the generation of bioenergy from renewable resources, and systems integration. The technologies and management solutions can apply to community and home gardens as well as commercial urban farms.

- ARS received pilot authority in the Food, Conservation, and Energy Act of 2008 (the 2008 Farm Bill) to initiate Enhanced Use Lease (EUL) activities at the Henry A. Wallace Beltsville Agricultural Research Center (BARC). In FY 2009, a Request for Proposals (RFP) was drafted for four different lease opportunities. Tenants at BARC would be required to develop formal research partnerships with ARS researchers or licensing agreements to commercialize ARS research outcomes that produced protectable IP.

- As part of the redesigning of bioenergy research programs in ARS, discussions were held among program managers, line managers from the Midwest Area Office (Peoria, IL), and program and line managers from the FS's Forest Product Laboratory in Madison, WI. Further discussions were held at ARS and FS headquarters. Subsequently, an expanded FS and ARS joint program in bioenergy research was agreed upon, and the resultant Memorandum of Understanding between ARS and FS was executed late in FY 2009. This strengthened alliance is expected to involve ARS and Forest Service scientists from across the USDA research locations and will complement research activities of the Bioenergy Research Centers funded by Department of Energy.

- Beginning with FY 2006, ARS-OTT expanded its services to APHIS-WS, and this Annual Report includes sections on APHIS-WS. Research operations for APHIS-WS are centered in Ft. Collins, CO at the National Wildlife Research Center (NWRC) where research activities focus on four major areas. These include Bird Research (e.g., hazards to aircraft, nonlethal repellents and attractants), Mammal Research (e.g., wildlife impacts on forest damage, predator ecology, behavior and management, and rat damage to crops), Product Development Research (e.g., analytical chemistry, APHIS pesticide registrations and labels, Brown Tree Snake control, wildlife damage management, immunocontraception and other fertility controls), and Wildlife Disease Research (e.g., rabies and bovine tuberculosis, avian disease, chronic wasting disease, and pseudorabies).

- A Memorandum of Understanding (MOU) was signed between ARS and the National Aeronautics and Space Administration (NASA) for cooperation in space-related biological and environmental research. This partnership will focus on the application of the United States portion of the International Space Station (ISS) as a "National Laboratory", as established by P.L. 109-155. The designation as a National Laboratory underscores the significance and importance that the United States places on the scientific potential of the ISS for research in areas including, but not limited to: 1) basic biological mechanisms in the absence of gravity; 2) plant and animal physiology and metabolism; 3) genetic regulation of plant and animal cell growth and differentiation; and 4) plant and animal pathogen infectivity and host immunity. In FY 2009, the first CRADA was established for research on the ISS.

- For the first time, ARS Licensing/Patent officials were successful in working with the Department of Commerce, United States Patent and Trademark Office to obtain an interim extension under 35 U.S.C.156(d)(5) for a one year extension of the term of an ARS-owned U.S. patent to support a licensee. "Section 156 of Title 35, U.S. Code, generally provides the term of a patent may be extended for a period up to five years if the patent claims a product, or a method of making or using a product, that has been subject to certain regulatory review, and that the patent may be extended for interim periods of up to a year if the regulatory review is anticipated to extend beyond the expiration date of the patent."

Collaborative Relationships for Research & Development (R&D)

CRADAs and Other R&D

Agricultural Research Service (ARS)	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **CRADAs**, total active in the FY	199	185	207	230	233
- New, executed in the FY	55	50	55	69	69
▪ Traditional CRADAs, total active in the FY	171	163	184	202	191
- New, executed in the FY	45	40	47	63	51
▪ Non-traditional CRADAs, total active in FY	28	22	23	28	42
- New, executed in the FY	11	10	8	6	18
▪ Material Transfer - CRADA, total active in the FY	6	7	5	3	10
- New, executed in the FY	3	2	2	1	7
▪ Master, total active in the FY	1	1	1	1	1
- New, executed in the FY	0	0	0	0	0
▪ Multiple Cooperators, total active in the FY	17	7	10	12	15
- New, executed in the FY	4	1	3	3	5
▪ Foreign - CRADA, total active in the FY	9	7	7	12	16
- New, executed in the FY	4	2	3	2	6
● **Amendments**[2], total in the FY	70	73	77	76	74
● Scientific Germplasm Releases (Public & Protected)	N/A	N/A	N/A	N/A	58
● **Other Collaborative R&D Relationships**, total active in the FY[3]					
▪ Confidentiality Agreements					
- New, executed in the FY	242	227	329	270	251
▪ Material Transfer Agreements					
- New, executed in the FY	722 [4]	700 [5]	788 [6]	884 [7]	784 [8]
▪ Other Agreements, total active in the FY	5,028	3,477	4,084	5,466	9,960
- New, executed in the FY	722	676	1,159	1,729	1,381
● **Animal and Plant Health Inspection Service (APHIS)**					
▪ CRADAs, total active in the FY	N/A	2	3	3	4
- New, executed in the FY	N/A	2	1	0	1
▪ Material Transfer - CRADA, total active in the FY	N/A	1	7	10	16
- New, executed in the FY	N/A	N/A	6	3	3
▪ Confidentiality Agreements	N/A	N/A	12	16	22
- New, executed in the FY	N/A	N/A	4	4	6
● **Forest Service (FS)**					
▪ CRADAs, total active in the FY	N/A	8	20	19	22
- New, executed in the FY	N/A	5	13	7	9

[1] Data for FY 2006 from APHIS & FS were originally reported with ARS CRADA data. APHIS & FS data is now separate and reflected in rows identified for their agency.
[2] Amendments extend existing CRADAs for additional years to a maximum of five years, and/or change Statements of Work, and/or change funding levels.
[3] Includes Trust Fund Agreements, Reimburseable Agreements, and Non-Funded Cooperative Agreements; data incomplete for FY2004.
[4] Includes 523 processed for outgoing materials, representing research outcomes of interest to other researchers and private-sector companies.
[5] Includes 500 processed for outgoing materials, representing research outcomes of interest to other researchers and private-sector companies.
[6] Includes 564 processed for outgoing materials, representing research outcomes of interest to other researchers and private-sector companies.
[7] Includes 648 processed for outgoing materials, representing research outcomes of interest to other researchers and private-sector companies.
[8] Includes 550 processed for outgoing materials, representing research outcomes of interest to other researchers and private-sector companies.

Invention Disclosure and Patenting

Intellectual Property Management[1]

Agricultural Research Service (ARS)	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● New invention disclosures in the FY	125	105	124	133	153
● Patent applications filed in the FY	88	83	107	114	117
▪ Non-Provisional	62	59	68	74	86
▪ Provisional	26	24	39	40	31
● Patents issued in the FY	27	39	35	27	21

Forest Service (FS)	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● New invention disclosures in the FY	N/A	N/A	2	0	1
● Patent applications filed in the FY	N/A	N/A	7	9	6
▪ Non-Provisional	N/A	N/A	5	5	4
▪ Provisional	N/A	N/A	2	4	2
● Patents issued in the FY	N/A	N/A	2	3	3

[1] Includes data from APHIS. Includes data from FS through FY 2006.

Licensing

Profile of Active Licenses [1]

Agricultural Research Service (ARS)	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **All licenses**, number total active in the FY	320	332	327	315	316
▫ New, executed in the FY	33	25	25	27	25
▪ **Invention licenses**, total active in the FY	320	332	327	315	316
▫ New, executed in the FY	33	25	25	27	25
- Patent licenses, total active in FY	309	316	327	291	288
▫ New, executed in the FY	28	20	24	23	21
- Material transfer (invention), total active in FY	11	16	22	24	28
▫ New, executed in the FY	5	5	5	4	4

Forest Service (FS)	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **All licenses**, number total active in the FY	N/A	N/A	12	13	13
▫ New, executed in the FY	N/A	N/A	0	1	0
▪ **Invention licenses**, total active in the FY	N/A	N/A	12	13	13
▫ New, executed in the FY	N/A	N/A	0	1	0

[1]"Active" means legally in force at any time during the FY, whether or not the license is incoming bearing. USDA licenses are patent invention and material transfer (invention) licenses. There are no other invention licenses or other IP licenses. FS data included for FY 2006.

Income Bearing Licenses[1]

Agricultural Research Service (ARS)	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **All income bearing licenses**, number	318	330	337	313	314
▫ Exclusive	220	233	241	223	222
▫ Partially exclusive	37	32	24	20	20
▫ Non-exclusive	61	65	72	70	72
▪ **Invention licenses**, income bearing	318	330	337	313	314
▫ Exclusive	220	233	241	223	222
▫ Partially exclusive	37	32	24	20	20
▫ Non-exclusive	61	65	72	70	72
- Patent licenses, income bearing	307	314	315	289	286
▫ Exclusive	220	233	238	220	218
▫ Partially exclusive	37	32	24	20	20
▫ Non-exclusive	50	49	53	49	48
- Material transfer (invention) licenses, income bearing	11	16	22	24	28
▫ Exclusive	0	0	3	3	4
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	11	16	19	21	24
● **All royalty bearing licenses**, number [2]	99	100	106	112	129
▪ **Invention licenses**, royalty bearing	99	100	106	112	129
- Patent licenses, royalty bearing	96	93	101	104	120
- Material transfer (invention) licenses, royalty bearing	3	7	5	8	9

[1] Includes data from FS.

[2] Totals include only those licenses that actually ***received*** royalty income.

Licensing Management

Agricultural Research Service (ARS)	FY 2005[1]	FY 2006[2]	FY 2007[3]	FY 2008[4]	FY 2009[5]
● **Number of licenses**					
▪ **Invention licenses**, total active in the FY	320	332	339	315	316
▫ New, executed in the FY	33	25	25	27	25
● **Elapsed execution time**, licenses granted in the FY					
▪ **Invention licenses**					
▫ average (months)	5.5	11.2	8.9	4.8	6.7
▫ median (months)	3.5	7.6	8.2	5.0	6.8
▫ minimum (months)	1.1	2.3	2.6	0.5	0.7
▫ maximum (months)	21.7	27.7	23.7	11.4	18.4
- Exclusive and partially exclusive invention licenses					
▫ average (months)	4.3	14.3	11.6	7.3	9.7
▫ median (months)	3.9	15.0	9.3	6.6	7.9
▫ minimum (months)	1.1	3.9	3.0	3.9	5.5
▫ maximum (months)	9.2	27.7	23.7	11.4	18.4
- Non-exclusive invention licenses					
▫ average (months)	6.8	6.7	6.9	2.3	3.2
▫ median (months)	2.9	5.9	8.2	1.0	1.8
▫ minimum (months)	1.7	2.3	2.6	0.5	0.7
▫ maximum (months)	21.7	12.1	11.5	6.0	8.0
▪ **Patent invention licenses**					
▫ average (months)	6.1	12.1	9.6	7.2	8.2
▫ median (months)	3.9	7.6	7.2	6.0	7.3
▫ minimum (months)	1.1	2.3	2.6	3.9	1.2
▫ maximum (months)	21.7	27.7	23.7	11.4	18.4
- Exclusive and partially exclusive patent invention licenses					
▫ average (months)	4.3	14.3	11.6	7.3	10.1
▫ median (months)	3.9	15.0	9.3	6.6	8.4
▫ minimum (months)	1.1	3.9	3.0	3.9	5.5
▫ maximum (months)	9.2	27.7	23.7	11.4	18.4
- Non-exclusive patent invention licenses					
▫ average (months)	8.6	4.8	6.5	6.0	1.3
▫ median (months)	5.8	5.9	6.4	6.0	1.3
▫ minimum (months)	2.6	2.3	2.6	6.0	1.2
▫ maximum (months)	21.7	6.3	11.5	6.0	1.4
▪ **Material transfer (invention) licenses**					
▫ average (months)	2.3	8.2	7.3	1.8	4.4
▫ median (months)	2.3	8.4	9.2	0.6	4.7
▫ minimum (months)	1.7	3.9	3.0	0.5	0.7
▫ maximum (months)	2.9	12.1	9.2	5.8	8.0
- Non-exclusive material transfer (invention) licenses					
▫ average (months)	2.3	8.2	7.3	1.8	4.0
▫ median (months)	2.3	8.4	9.2	0.6	3.7
▫ minimum (months)	1.7	3.9	3.0	0.5	0.7
▫ maximum (months)	2.9	12.1	9.2	5.8	8.0
● **Licenses terminated for cause**, in the FY					
▪ Invention licenses	0	0	0	0	0
▪ Patent invention licenses	0	0	0	0	0
▪ Material transfer (invention) licenses	0	0	0	0	0

Footnotes to table provided on next page.

[1] Based upon 14 licenses granted to commercial licensees. FY 2005 data does not include the elapsed execution time (29.4 months) for a license granted to a commercial co-owner who delayed the company's decision to license USDA's rights in the licensed invention. The elapsed execution time data presented also does not include licenses executed with universities for co-owned inventions. In accordance with 35 USC 202(e), such licenses are granted for the purpose of consolidating rights in the invention, and therefore a license application is not required.

[2] During FY 2006, USDA received 35 new invention license applications, for which 1 new license was granted, 23 license agreements are currently in negotiation, 4 applications were withdrawn by the applicants, and 7 applications are on hold by request of the applicants. The FY 2006 data is based upon 17 licenses granted to commercial licensees and does not include licenses executed with universities for co-owned inventions. In accordance with 35 USC 202(e), such licenses are granted for the purpose of consolidating rights in the invention, and therefore license applications are not required.

[3] During FY 2007, USDA received 32 new invention license applications, for which 5 new licenses were granted, 22 license agreements are currently in negotiation, 1 application was withdrawn by the applicant, and 4 applications are on hold by request of the applicants. The FY 2007 data is based upon 19 licenses granted to commercial licensees and does not include licenses executed with universities for co-owned inventions. In accordance with 35 USC 202(e), such licenses are granted for the purpose of consolidating rights in the invention, and therefore license applications are not required. Totals include only those licenses that actually received royalty income.

[4] During FY 2008, USDA received 30 new invention license applications, for which 7 new licenses were granted, 20 license agreements are currently in negotiation, 5 applications were withdrawn by the applicant. The FY2008 data is based upon 16 licenses granted to commercial licensees and does not include licenses executed with universities for co-owned inventions. In accordance with 35 USC 202(e), such licenses are granted for the purpose of consolidation rights in the invention, and therefore license applications are not required.

[5] During FY 2009, USDA received 31 new invention license applications, for which 7 new licenses were granted, 14 license agreements are currently in negotiation, 5 applications were withdrawn by the applicants, and 5 applications are on hold by request of the applicants. The FY 2009 data is based upon 15 licenses granted to commercial licensees and does not include licenses executed with universities for co-owned inventions. In accordance with 35 USC 202(e), such licenses are granted for the purpose of consolidating rights in the invention, and therefore license applications are not required.

License Income [1]

Agricultural Research Service (ARS)	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **Total income**, all patent invention licenses active in the FY	$3,315,486	$3,161,869	$3,588,148	$3,953,415	$5,376,463
▪ **Invention licenses**	$3,315,486	$3,161,869	$3,588,148	$3,953,415	$5,376,463
- Patent licenses	$3,302,371	$3,100,219	$3,521,739	$3,883,922	$5,318,483
- Material transfer (invention licenses)	$13,115	$61,650	$46,409	$69,493	$57,980
▪ **Other IP Licenses**	$0	$0	$0	$0	$0
● **Total Earned Royalty Income** (ERI)	$2,089,174	$2,337,323	$2,681,552	$3,009,774	$4,422,023
▫ Median ERI	$5,325	$5,000	$4,657	$4,258	$4,485
▫ Minimum ERI	$49	$18	$12	$7	$12
▫ Maximum ERI	$263,648	$230,296	$388,730	$761,553	$1,715,890
▫ ERI from top 1% of licenses	Not presented [2]	Not presented [2]	Not presented [2]	Not presented [2]	Not presented [2]
▫ ERI from top 5% of licenses	$890,414	$908,123	$1,230,251	$1,657,059	$2,756,811
▫ ERI from top 20% of licenses	$1,647,700	$1,879,229	$2,205,066	$2,543,565	$3,874,292
▪ **Invention licenses,** total ERI	$2,089,174	$2,337,323	$2,681,552	$3,009,774	$4,422,023
▫ Median ERI	$5,325	$5,000	$4,657	$4,258	$4,485
▫ Minimum ERI	$49	$18	$12	$7	$12
▫ Maximum ERI	$263,648	$230,296	$388,730	$761,553	$1,715,890
▫ ERI from top 1% of licenses	Not presented [2]	Not resented [2]	Not presented [2]	Not presented [2]	Not presented [2]
▫ ERI from top 5% of licenses	$890,414	$908,123	$1,230,251	$1,657,059	$2,756,811
▫ ERI from top 20% of licenses	$1,647,700	$1,879,229	$2,205,066	$2,543,565	$3,874,292
- Patent (and patent application) licenses, total ERI	$2,083,059	$2,301,172	$2,662,122	$2,982,281	$4,386,042
▫ Median ERI	$5,601	$5,194	$4,662	$4,579	$4,612
▫ Minimum ERI	$49	$18	$89	$45	$117
▫ Maximum ERI	$263,648	$230,296	$388,730	$761,553	$1,715,890
▫ ERI from top 1% of licenses	Not presented [2]	Not presented [2]	Not presented [2]	Not presented [2]	Not presented [2]
▫ ERI from top 5% of licenses	$890,414	$908,123	$1,230,251	$1,544,031	$2,756,811
▫ ERI from top 20% of licenses	$1,624,258	$1,854,214	$2,178,046	$2,485,319	$3,819,292
- Material transfer (invention licenses), total ERI	$6,115	$36,150	$19,430	$27,493	$35,980
▫ Median ERI	$1,925	$2,645	$3,428	$1,003	$3,186
▫ Minimum ERI	$600	$153	$12	$7	$12
▫ Maximum ERI	$3,591	$17,053	$9,784	$9,508	$13,690
▫ ERI from top 1% of licenses	$3,591	$17,053	$9,784	$9,508	$13,690
▫ ERI from top 5% of licenses	$3,591	$17,053	$9,784	$9,508	$13,690
▫ ERI from top 20% of licenses	$3,591	$17,053	$9,784	$18,573	$21,282
Forest Service (FS)	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**FY 2009**
● **Total income**, all licenses active in the FY	N/A	N/A	$46,080	$25,015	$6,655
▪ **Invention licenses**	N/A	N/A	$46,080	$25,015	$6,655
- Patent licenses	N/A	N/A	$46,080	$25,015	$6,655

[1] Includes data from USDA, Forest Service through FY 2006.

[2] Represents a single license.

Disposition of License Income [1]

Agricultural Research Service (ARS)	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **Income distributed**[2]					
▪ **Invention licenses**, total distributed	$2,675,740	$2,561,281	$3,158,217	$3,013,552	$3,673,922
▫ To Inventors	831,375	998,042	1,015,450	756,458	1,371,346
▫ To Others	1,226,104	1,032,573	1,344,186	1,562,427	1,633,536
- Patent licenses, total distributed	$2,661,184	$2,534,208	$3,114,853	$2,958,996	$3,631,660
▫ To inventors	$821,677	$982,756	$990,344	$728,892	$1,346,512
▫ Salaries of some technology transfer staff	$1,221,246	$1,020,786	$1,325,928	$1,535,437	$1,616,108
▫ Patent filing preparation, fees, & patent annuity payments	$618,261	$530,666	$798,581	$694,667	$669,040
▫ Other technology transfer expenses	$0	$0	$0	$0	$0
- Material transfer (invention) licenses, total distributed	$14,556	$27,073	$43,364	$54,556	$42,262
▫ To Inventors	$9,698	$15,286	$25,106	$27,566	$24,834
▫ Salaries of some technology transfer staff	$4,858	$11,787	$18,258	$26,990	$17,428
▫ Patent filing preparation, fees, & patent annuity payments	$0	$0	$0	$0	$0
▫ Other technology transfer expenses	$0	$0	$0	$0	$0

Forest Service (FS)	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **Income distributed**					
▪ **Invention licenses**, total distributed	N/A	N/A	$15,890	$8,500	$6,000
▫ To Inventors	N/A	N/A	$15,890	$8,500	$6,000
▫ To Others	N/A	N/A	$0	$0	$0
- Patent licenses, total distributed	N/A	N/A	$15,890	$8,500	$6,000
▫ To Inventors	N/A	N/A	$15,890	$8,500	$6,000
▫ To Others	N/A	N/A	$0	$0	$0

[1] Includes data from FS through FY 2006.

[2] Some of income distributed reflects income received in the prior fiscal year.

DOWNSTREAM OUTCOMES FROM ARS TECHNOLOGY TRANSFER ACTIVITIES[2]

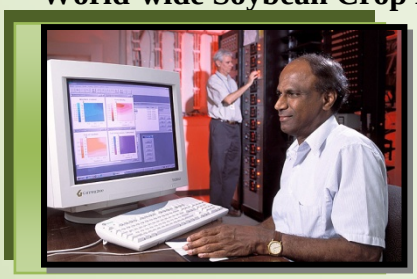
SUSTAINED FOOD PRODUCTION

- 517 Research Projects
- 107 Locations
- 1,192 Scientists

Conserving Crop Diversity

For thousands of years, in the northern Andean highlands of Ecuador, people surrounding the town of Cotacachi have cultivated crops across a wide range of elevations, climates, and soils. The result is a microcenter of agricultural diversity. ARS researchers from the Beltsville Area's National Germplasm Resources Laboratory in Beltsville, MD, established and now advises a program designed to promote conservation and increase the use of local crops in the area. This program involved partnering with an indigenous community organization, the Union of Indigenous and Peasant Communities (UNORCAC), scientists from Biodiversity International, and their ARS equivalent in Ecuador. This Cotacachi project was in large part responsible for UNORCAC being awarded the Equator Prize from the United Nations Development Program in 2008 in recognition of efforts to conserve agricultural biodiversity. This research is part of *Crop Production*, an ARS national program (#305).

World-wide Soybean Crop Modeling

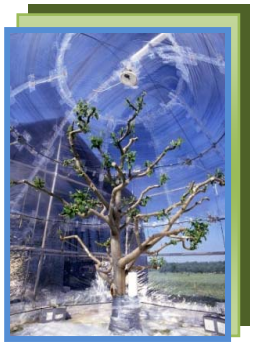


ARS scientists at the Beltsville Area's Crops Systems and Global Change Laboratory in Beltsville, MD, developed a soybean crop model GLYCIM to pinpoint the best agronomic practices for maximizing soybean production within the US. They are now improving GLYCIM performance under a range of conditions around the world. ARS researchers have now partnered with Drs. S. B. Lokhandle and V.M. Salokhe (Asian Institute of Technology in Pathumthani, Thailand) to develop 504 cultivation and yield scenarios for two key soybean production areas in northern Thailand. GLYCIM results also indicated that it is critical for farmers to use optimal planting dates to achieve high yields at these sites. Yield losses in delayed planting simulations averaged around 30 percent. These results further support GLYCIM's use as a comprehensive mechanistic model for predicting

[2] Each outcome references the associated ARS intramural national program number. More information on each can be found at http://www.ars.usda.gov/research/programs.htm

soybean growth, development and yield across a range of agricultural systems. This research is part of *Crop Production*, an ARS national program (#305).

Particle Film Technology -- UPDATE



ARS scientists at the North Atlantic Area's Appalachian Fruit Research Station in Kearneysville, MD developed and licensed 13 patented-technologies on particle film technology that have been used over ten years to combat insect pests and environmental stresses, such as sunburn and heat stress, in many fruits and vegetable crops. The technology is based on inert mineral particle, kaolin, and is licensed by TKI International under the name, Surround WP. This crop protectant offers a non-chemical, environmentally safe, replacement to insecticides and is a novel approach to preventing fruit and vegetable damage due to extreme environmental conditions. Now sold internationally, its impact on agriculture continues to increase and is used in both organic and conventional fruit production. This research is part of *Crop Production*, an ARS national program (#305).

Blackberry Trellis System

Blackberry production in the Midwest and Northeast is problematic because blackberry canes are susceptible to low winter temperature injury. In the Southeast and in the Central Valley of California fruit that are exposed to intense sunlight are sunburned and become un-marketable. ARS researchers at the North Atlantic Area's Appalachian Fruit Research Station in Kearneysville, WV, helped solve these important economic problems. ARS developed a new trellis system called the rotatable cross-arm (RCA) a novel method of training canes to grow on the RCA trellis. Because the cross-arms can be rotated, the entire blackberry plant (normally upright) can be moved close to the ground in winter without causing cane breakage. A winter protection cover can then be installed on top of low-lying canes to reduce winter injury. In spring, rotating the cross-arms up to vertical positions all fruit to one side of the row under leaves and away from direct sunlight, thereby reducing sun damage. This research is part of *Crop Production,* an ARS national program (#305).

MaizeGDB (Maize Genetics and Genomic Database) -- UPDATE

Maize is a major crop worldwide. It is used in human food and animal feed, as well as in manufacturing of diverse industrial products and ethanol production. Improvements in maize varieties and production and the development of new uses are a result of extensive basic research. The Maize Genetics and Genomic Database (MaizeGDB) is the maize research community's central repository for genetics and genomics information. ARS scientists at the Midwest Area's Corn Insects and Crop Genetics Research Unit in Ames, IA, in collaboration with Iowa State University developed the database, which became publicly available in 2003. MaizeGDB (http://www.maizegdb.org) incorporates data from earlier versions of two ARS databases MaizeDB and ZmDB, a database that was initiated through the National Science

Foundation-funded Maize Gene Discovery Project. Input from academia, industry, and Federal scientists lead to the development of the MaizeGDB Genome Browser, which became available late in 2008. MaizeGDB's impact is reflected in the site's usage. Hits to the MaizeGDB Website have averaged approximately 400,000 per month over the past year, with a marked increase in use after release of the MaizeGDB Genome Browser. This research is part of *Plant Genetic Resources, Genomics, and Genetic Improvement*, an ARS national program (#301).

Soybean Genetics and Genome Database

SoyBase (http://soybase.org) is a soybean genetics and genome database developed by ARS scientists. Access to this public database provides genetic, physical and sequence databases to soybean researchers worldwide. More recently ARS scientists developed and released "The Soybean Breeder's Toolbox," which is a new interface to SoyBase, which is specifically designed to assist soybean breeders in identifying genomic sequences associated with particular agronomic traits of interest. In order to facilitate use of the database, ARS scientists developed tutorials and presented seminars at national and international meetings. In a single month this year, SoyBase was accessed by 1700 users from over 50 countries. In addition, the underlying SoyBase database model has been adopted for use in development of databases for the western corn rootworm (WCRbase) and for lepidopteran corn pests (LepDB), with several other databases in progress. This research is part of *Plant Genetic Resources, Genomics, and Genetic Improvement*, an ARS national program (#301).

New Varieties of Berries

ARS researchers at the Pacific West Area's Horticultural Crops Research Unit in Corvallis, OR, have been breeding small fruits - blackberry, strawberry, and raspberry - since approximately 1993. ARS began releasing new varieties of berries starting in the early 2000s, and blackberries in particular have been widely adopted by Pacific Northwest berry producers. During the period 2005-2008, for example, more than one third of all blackberry plants sold by nurseries were cultivars from ARS' program. Stakeholder support for ARS' program is strong and growing because of this success in producing new cultivars that are extremely viable from a commercial perspective. This research is part of *Crop Production,* an ARS national program (*#305*).

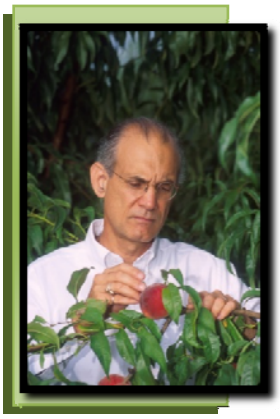
New Legume, Small Grain, and Hop Varieties

ARS researchers at the Pacific West Area's Grain Legume Genetics and Physiology Research Unit in Pullman, WA, released a new variety of lentil, named *Essex*. This new variety has been favorably received by the Dry Pea and Lentil Council, an industry group that closely follows ARS research and that helps with market penetration of new varieties. ARS researchers also released a new variety of barley,

Endeavor. Similarly, ARS researchers at the Forage Seed and Cereal Research Unit in Corvallis, OR released a new hop variety, *Mt. Rainier*. This research is part of *Plant Genetic Resources, Genomics, and Genetic Improvement,* an ARS national program *(#30*1).

New Peach Varieties

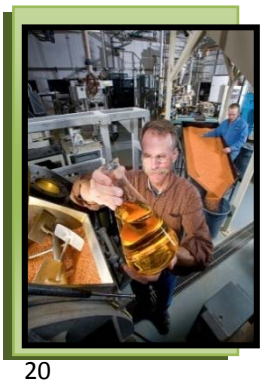
ARS researchers at the North Atlantic Area's Appalachian Fruit Research Station in Kearneysville, WV, have developed important and flavorful new peach varieties over the last decade. Sentry and Bounty peaches have become two of the best peach varieties for commercial peach production in the eastern United States–Sentry for the early season and Bounty for mid-season. Bounty has become the commercial standard for mid-season peaches. They are the two most important early and mid-season varieties for commercial peach production in New Jersey, the largest peach producing state in the Northeast. Both varieties are praised for their size, firmness, and resistance to bacterial spot—a major peach disease. Other new varieties, Sweet-N-UP and Crimson Rocket, were the first introductions for the upright and pillar tree forms, respectively. They have great potential for commercial high density peach plantings–something that could not be accomplished with the traditional/standard peach tree form. Through a Cooperative Research and Development Agreement with Adams County Nursery, Aspers, PA a new upright variety, SummerFest, was introduced. It has great potential, and the first trees were made available to growers Spring 2009. This research is part of *Crop Production,* an ARS national program (*#305*).



New Forage Grasses

ARS researchers at the Southern Plains Area's Jornada Experimental Range in Las Cruces, NM, have developed and publicly released a new forage grass variety of eastern gamagrass, named Verl. It has been tested extensively throughout the eastern United States from Oklahoma to New York and Florida. Verl averages an 11 percent increase in dry matter compared to other commonly planted eastern gamagrass cultivars. This new variety will offer higher yielding pastures for U.S. agriculture. This research is part of *Pasture, Forage and Range Land Systems,* an ARS national program (#215).

New Vitamin Mix Gives Farmed Fish Vim and Vigor



Just like people, fish have a daily vitamin quota. For instance, one of America's most popular farmed fish, rainbow trout, need at least a dozen different kinds of essential vitamins so they can grow normal and stay healthy. Now, ARS researchers at the Pacific West Area's Hagerman Fish Culture Experiment Station in Hagerman, ID, have made it easier for trout and other fish to get those vitamins. This has been accomplished by developing an updated, pre-blended vitamin mix. It's a publicly available

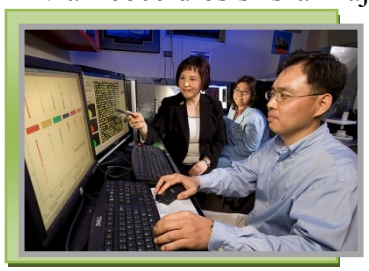
recipe. It's already being added to fish feeds that are eagerly gobbled up, not just by rainbow trout at fish farms and hatcheries, but also by rare and endangered species being raised in captivity for release into the wild. This research is part of *Aquaculture,* an ARS national program (#106).

Plant-Based Fish Feeds

ARS researchers at the Pacific West Area's Hagerman Fish Culture Experiment Station in Hagerman, ID, have developed a new Plant-Based Fish Food. The plant-based feed used in the study was derived from corn, wheat, and soy. But why the interest in using plants as a major source of fish feed ingredients as replacements for the traditional choices—fishmeal and fish-oil. Plant based feeds will reduce aquaculture's reliance on ocean-harvested fish such as menhaden, and therefore, these feeds are thought to be more sustainable. What's more, plant-based feeds sidestep two other problems, namely, high levels of contaminants such as PCBs, found in some ocean-going fish, and high levels of phosphorus in fishmeal, a nutrient that can cause water - pollution problems. This research is part of *Aquaculture,* an ARS national program (#106).

Avian Coccidiosis Control

Avian coccidiosis is a major parasitic poultry disease, costing U.S. producers well over $600 million annually in economic losses. Poultry producers may use antibiotics and vaccines to treat and protect birds against this disease; however the parasite can develop resistance to the drugs. As an alternative strategy, ARS researchers at the Beltsville Area's Animal Parasitic Diseases Laboratory in Beltsville, MD, teamed with scientists from Investigation Aplicada, S. A. (IASA) in Puebla, Mexico and the Department of Pediatrics, School of Medicine, University of Maryland, Baltimore, MD to demonstrate the efficacy of inducing passive immunity against coccidiosis by orally feeding hyperimmune IgY antibodies to the poultry. Based upon these results, ARS collaborated with IASA to develop a commercial product that could be fed to chickens to control coccidiosis. This research is part of *Animal Health,* an ARS national program (#103).



Selection Programs in Dairy Cattle - UPDATE

ARS scientists at the Beltsville Area's Bovine Functional Genomics Laboratory (BFGL) and Animal Improvement Programs Laboratory in Beltsville, MD, have been working toward the use of high-density genomic data to enhance traditional selection programs in dairy cattle. The two groups took advantage of expertise across the groups as well as bringing in skills from outside Beltsville and ARS, including ARS scientists at the Northern Plains Area's Roman L. Hruska U.S. Meat Animal Research Center in Clay Center, NE, faculty from the

University of Missouri, and technology experts from Illumina, Inc., a genomics company in San Diego, CA. Different teams attacked several aspects of the project simultaneously, with BFGL leading the identification of additional genetic markers needed to build the DNA analysis tool. BFGL scientists also led the development of the DNA assay, which has been commercialized by Illumina as the BovineSNP50 beadchip, a state of the art genotyping resource. ARS scientists were also developing the statistical tools needed to use this information to increase the accuracy of predicting genetic value. The pieces all came together in early 2008, with the release of the first "genome enhanced breeding values" to industry collaborators in the United States and Canada. These new genetic values have been rapidly accepted by the dairy industry. More than 15,000 animals have been characterized for more than 40,000 locations in the cow genome through this collaboration. This research is part of *Animal Production,* an ARS national program (#101).

New Genomic Technology for Cattle

ARS researchers at the Northern Plains Area's Roman L. Hruska U.S. Meat Animal Research Center in Clay Center, NE, have completed a simulation study that showed selecting sires for improved feed efficiency results in a 10 percent increase in feed efficiency of calves during the post-weaning period. The predicted increase in feed efficiency was accompanied by a small increase in daily gain during this same period. A new automated facility that records individual feed intake, water intake, feeding behavior, and weight-gain data was completed and is operating at full capacity—generating over 22,000 feed and water events per day on 300 head of cattle. Implementation of new genomic technology has resulted in the generation of 167 million genotypes on 3,600 cattle (52,156 DNA markers per animal) that have been characterized for feed efficiency and other production traits. Genotypes are being associated with individual feed efficiency data to develop markers to select superior sires for feed efficiency and to provide management tools to increase profitability for producers. This research is part of *Plant Genetic Resources, Genomics, and Genetic Improvement,* an ARS national program (#301).

Prion Gene *PRNP*

ARS researchers at the Midwest Area's Virus and Prion Research Unit in Ames, IA, identified a prion gene *PRNP* haplotype that associates with atypical bovine spongiform encephalopathy (BSE). Atypical BSEs are rare prion diseases that have been identified in Asian, European and North American cattle. Two cases have been confirmed within the United States. In 2007, ARS established collaboration with investigators in France, Canada and fellow ARS scientists at the National Animal Disease Center to elucidate the genetics of atypical BSE susceptibility. AHRU characterized *PRNP* variation in atypical BSE cases from Canada, France, and the United States and identified the haplotype association with atypical BSE. The significance of this finding isn't the haplotype itself, but evidence that a majority of atypical BSE cases are attributable to underlying

genetic susceptibility. This argues against a spontaneous origin for many atypical BSE cases. This research is part of *Animal Health,* an ARS national program (#103).

Streptococcal Vaccine Team

ARS researchers at the Mid South Area's Aquatic Animal Health Research Unit in Auburn, AL, developed and transferred multiple vaccines for *Streptococcus iniae* and *Streptococcus agalactiae*, for catfish. The vaccines consist of killed bacterial cells supplemented with molecular fractioned extracellular products. These vaccines may be administered by injection, immersion, or orally. They are trend setting advancements in fish vaccinology worldwide, as extracellular products and mass immunization strategies (immersion and oral) had not previously been considered to be efficacious in the delivery of killed vaccine formulations. This research is part of *Aquaculture,* an ARS national program (#106).

Rift Valley Fever Outbreak Early-Warning Team

Rift Valley fever (RVF) is a viral disease of domestic animals and humans that occurs throughout sub-Saharan Africa. RVF has global implications because of its expanding range. RVF causes severe infections in domestic animals, resulting in mortality as high as 80 percent, and produces very serious human disease and death. ARS researchers at the South Atlantic Area's Center for Medical, Agricultural, and Veterinary Entomology in Gainesville, FL, discovered that disease outbreaks are episodic, and are closely linked to global and regional climate variability. This discovery is based on a study of an RVF outbreak that occurred in 1997-1998 in the Horn of Africa. This outbreak involved five countries with a loss of approximately 100,000 domestic animals, approximately 90,000 human infections. The World Organization for Animal Health estimated economic losses from trade restrictions of more than $100 million. To directly address the threat of globalization of RVF, ARS scientists and personnel from multiple U.S. and international agencies, developed a highly innovative and effective method to forecast RVF outbreaks. This method is based on global climate conditions that determine the local and regional ecological conditions that cause the emergence of the virus in Africa. This novel and important technology has been effectively transferred to international, regional, and local agriculture and public health agencies in endemic countries and in countries at potential risk of this serious and deadly disease. This research is part of *Veterinary, Medical, and Urban Entomology,* an ARS national program (#104).

Screwworm Research

ARS researchers worked with APHIS International Services and the Panamanian-American Commission for Eradication of the Screwworm (COPEG) to solve key production problems at the new sterile-male screwworm production plant in Panama. Opening the $200 million facility was delayed by unacceptable levels of ammonia gas produced by larvae. USDA ARS

researchers performed experiments with the larval medium to produce a blend of ingredients that reduced ammonia to safe concentrations. As a result, millions of dollars in air-handling modifications were avoided and the plant was able to transition to full production at least a year earlier than expected. This research is part of *Veterinary, Medical, and Urban Entomology,* an ARS national program (#104).

New Mosquito Insecticide

ARS researchers at the South Atlantic Area's Center for Medical, Agricultural, and Veterinary Entomology, Mosquito and Fly Research Unit in Gainesville, FL, worked with Central Life Sciences, the Armed Forces Pest Management Board, the Navy Entomology Center of Excellence, IR-4, and the U.S. EPA to achieve registration of Zenivex (active ingredient etofenprox). Zenivex is a highly effective product for killing mosquitoes by application of very fine droplet in an aerosol dispensed by aircraft or trucks. This fine-droplet aerosol technology, known as ULV (ultra-low volume), was originally developed by USDA ARS in Gainesville. Zenivex contains the first new active ingredient for mosquito ULV in 20 years. This research is part of Veterinary, Medical, and Urban Entomology, an ARS national program (#104).

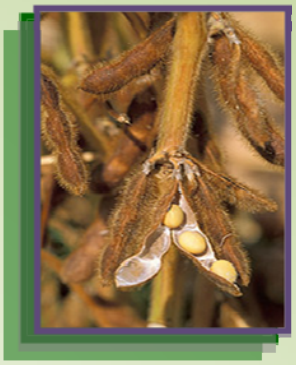
ARS Downstream Outcomes

BIOENERGY AND BIOPRODUCTS

- 133 Research Projects
- 29 Locations
- 257 Scientists

Biobased Sunscreen

ARS scientists at the Midwest Area's National Center for Agricultural Utilization Research in Peoria, IL,developed a novel technology for converting soybean oil into a highly effective, biobased sunscreen active ingredient. This technology relies on covalently incorporating ferulic acid, a natural phenolic compound, into vegetable oils. The fatty acid part of the product imparts the water-resistance required of effective sunscreens, while the feruloyl group provides UV protection and strong antioxidant properties. Combining ferulic acid with soybean oil (collectively referred to as SoyScreen™) produces a strong UV-A and UV-B absorbing material. This invention has been licensed and scaled up for commercial adoption. SoyScreen™ has successfully been marketed as a broad UV protection/antioxidant active ingredient. Additional sunscreen products are expected to be on the market in 2010. This Research is part of *Quality and Utilization of Agricultural Products,* an ARS National Program (*#306).*



Energy from Wastes

A research collaboration between ARS researchers at the Pacific West Area's Bioproducts, Chemistry, and Engineering Research Unit in Albany, CA, and Comprehensive Recovery, Re-use, and Recycle, Inc., has been in place for approximately two years. This collaboration has resulted in the recent implementation of a pilot plant production facility at a landfill in Salinas, CA, where a combination of municipal solid waste and agricultural waste is being processed and converted into ethanol. Large-scale commercial implementation will soon follow. This research is part of *Quality and Utilization of Agricultural Products,* an ARS national program (#306).

Improved Formulation for Charcoal

ARS researchers at the Pacific West Area's Bioproduct Chemistry and Engineering Research Unit in Albany, CA, have helped the Clorox Corporation improve its charcoal formulation. Work was done to reduce the cost of binders used in charcoal formulations by using agriculture-based binders. The new binders are not only more cost effective but they also work better than binders used in commercial formulations. Pilot studies are now in progress to evaluate the formulations during scale-up processes. This research is part of *Quality and Utilization of Agricultural Products,* an ARS national program (#306).

Fruit and Vegetable Wraps -UPDATE

ARS researchers at the Pacific West Area's Processed Foods Research Unit in Albany, CA, have developed 100 percent fruit and vegetable "wraps" or "papers" that can be used to package other healthy foods such as fish, oatmeal, cottage cheese, egg, polenta, bread, beans, nuts, etc. The wraps are shelf stable, tasty, and economical. The technology has been licensed to a start-up company, Origami Foods, LLC, Stockton, CA, which has recently opened a factory in an economically-depressed area. Origami's sales are quickly expanding and the American public will soon be able to obtain this product at selected stores and various restaurants. This research is part of *Quality and Utilization of Agricultural Products,* an ARS national program (#306).

Sugar-esters as Insecticides

Sugar-esters are a class of compounds typically used as food additives. ARS scientists at the North Atlantic Area's Appalachian Fruit Research Station in Kearneysville, WV, in collaboration with Applied Power Concepts of Orange, California, have patented several sugar ester chemistries with insecticidal activity. Two chemistries, sucrose octanoate and sorbitol octanoate, are commercially available insecticides that are marketed by NaturalForces, Davidson, North Carolina, as "Sucrashield" and "SorbiShield90", respectively. These insecticides offer a fast acting, environmentally safe, replacement for conventional insecticides for use against insect and mite pests of fruits and vegetables in fields, greenhouses and nurseries. Sucrose octanoate has also been marketed over the past 5 years as "Sucrocide" by Dadant and Sons, Inc., Hamilton, Illinois, for the control of deadly varroa mites on honey bees without harming the bees. The company developed a special sprayer to treat the bees within their hives to control the mites. The impact of these chemistries continues to grow as new agricultural pest control applications are found. This research is part of *Crop Production,* an ARS national program (#305).

CrispTek – ***An Early Success of the new Agricultural Technology Innovation Partnership Program***

In April 2008, CrispTek, LCC of Columbia, MD acquired the exclusive license right to the ARS patent (US 6,224,921) in an effort to commercialize ARS's low oil-uptake batter technology.

Researchers at the Mid South Area's Food Processing and Sensory Quality Unit in New Orleans, LA, developed the technology. Support for this startup company was provided, in part, by the Maryland Technology Development Corporation (TEDCO), using their Maryland Technology Transfer Fund. TEDCO was the inaugural Partner of the Agricultural Technology Innovation Partnership (ATIP) program, launched by ARS' Office of Technology Transfer in September 2007. ATIP was envisioned to assist business and research partners of ARS by providing complementary business assets (business development teams, financial resources, manufacturing consultants, etc.) in an effort to fast track the adoption and commercial development of ARS research outcomes. Because of TEDCO's involvement, CrispTek rolled out its first product, ChoiceBatter in June 2009, and it is currently available through their website at www.ChoiceBatter.com, and at over 300 retail stores across the U.S. Fried foods coated with the product are low in fat, gluten-free and Kosher-pareve. The development meets the need of healthier foods and thus will have an impact on the health and well being of US consumers. A follow-up CRADA between ARS and CrispTek is underway to study the effects of solvents on the textural and sensory properties of the batters. In late 2009, CrispTek entered into agreement with two major food distributors. This research is part of *Quality and Utilization of Agricultural Products*, an ARS national program (#306).

Swine Virus Research

Soon after the emergence of the H1N1 virus in April 2009, ARS scientists at the Midwest Area's National Animal Disease Center (NADC) in Ames, IA, and the South Atlantic Area's Southeast Poultry Research Laboratory in Athens, GA, began studying the virus using samples provided by the Centers for Disease Control and Prevention (CDC). Within a week of receiving the samples, ARS scientists developed rapid diagnostic tests for the virus, which were subsequently made available to state diagnostic labs and to other countries through the USDA, Animal Plant Health Inspection Service (APHIS). NADC scientists also evaluated current U.S. H1N1 swine influenza vaccines to determine if they could protect pigs from infection by the 2009 H1N1 influenza virus. Additional research continues to evaluate the efficacy of a select subset of swine influenza virus vaccines tested in the first study. This research is part of *Veterinary, Medical, and Urban Entomology*, an ARS national program (#103)

ARS Downstream Outcomes

NATURAL RESOURCES AND SUSTAINABILITY

- 152 Research Projects
- 68 Locations
- 464 Scientists

Chesapeake Bay Health

Technologies to help Maryland implement and monitor an expanded winter cover crop program have been developed by ARS researchers. Satellite images are used in combination with field information submitted by farmers enrolled in the state's cover crop cost-share program. As a result of this research,Maryland doubled its budget for it's cover crop cost-share program to $18 million in 2008-2009. This will provide for more than 387,000 acres of cover crops with no fall fertilization. This Research is part of *Crop Production,* an ARS national program (#305).

Water Savings in Irrigation Canals

A collaboration between ARS researchers at the Pacific West Area's Bioproducts, Chemistry, and Engineering Research Unit in Albany, CA, and the Innovium Corporation, St. Louis, MO, have continued to make gains in advancing alternatives to polyacrylimide (PAM). PAM is a chemical used to control water loss and seepage from earthen irrigation canals, but it is gradually being phased out due to environmental concerns. ARS researchers working with their private-sector collaborator devised, optimized, and scaled-up various formulations of activated, degradable biopolymers that are proving to be environmentally benign, and an excellent alternative to PAM. Innovium has been successful in marketing these formulations and is enjoying increasing sales and distribution of the product. This research is part of *Water Availability and Watershed Management,* an ARS national program (#211).

Community Control of Ticks – UPDATE

An environmentally friendly, patented device, called the "4-Poster" Deer Treatment Bait Station, was developed by ARS researchers. ARS researchers from the Beltsville Area's Animal Parasitic Diseases Laboratory led a study which showed the "4-Poster" technology annually achieved at least 77 percent control of deer-associated ticks on Gibson Island, MD. After the study, ARS established a protocol for the community on Gibson Island to continue the operation of the program. For the last four, the community obtained significant control in spite of increased

deer density and the use of 40 percent fewer "4-Poster" devices. This Research is part of *Veterinary, Medical, and Urban Entomology,* an ARS national program (#103).

Second Generation Treatment System for the Green and Profitable Management of Livestock Manure

The technology is a cost-effective alternative to open lagoons, which is the dominant method of handling hog wastes throughout the country. The technology has changed the way of thinking about manure management by solving multiple challenges in modern livestock production. These challenges include atmospheric emissions, excess nutrients (nitrogen and phosphorus), pathogens and food safety, odors, and affordability of treatment. The Second Generation Treatment System for the Green and Profitable Management of Livestock Manure Team have developed and effectively transferred a new technology that can solve all these problems. This technology was successfully designed in 2006, implemented in 2007 on a 5,600-head swine finishing farm in North Carolina, and demonstrated in full-scale. The demonstration was funded ($1 million) through an Environmental Enhancement Fund Program sponsored jointly by the NC Dept. of Justice and Smithfield Foods, the largest swine producer in the U.S., to demonstrate possible alternatives to anaerobic lagoons. This Research is part of *Manure and Byproduct Utilization,* an ARS national program (#206).

Applying Dry Poultry Litter

ARS researchers devised and tested a technique for applying dry poultry litter below the surface of perennial pasture with only minimal disturbance of the soil structure and forage crop. Results showed that subsurface litter produced more forage than surface-applied litter while decreasing ammonia volatilization, odors, and nutrient losses in runoff by-more than 90%. To develop the subsurface application technique as a practical management option for producers, the ARS team designed and implemented at tractor-dawn machine known us the "ARS Poultry Litter Subsurfer." This invention can transport five tons of poultry litter directly from the poultry house and rapidly apply it under the soil surface without the need for any pre-treatment (grinding) of the litter. The Use of the Poultry Litter Subsurfer will have a positive impact on agriculture and dramatically reduce the risk of phosphorus runoff into the waters of states. This Research is part of *Manure and Byproduct Utilization,* an ARS national program (#206).

Irrigation Management

Good irrigation management is required for the efficient and profitable use of water for irrigating agricultural crops. Effective irrigation scheduling can also conserve scarce water and energy resources. A team of USDA/ARS researchers developed a novel method and device, named BIOTIC, for managing the irrigation of plants using crop canopy temperature measurements. In the BIOTIC process, the canopy temperature of the target plant is measured at regular time intervals using an infrared thermometer. After each measurement, the canopy temperature is compared to a predetermined threshold canopy temperature, defined as approximately that canopy temperature which optimizes plant metabolism. Irrigation is turned on when the measured canopy temperature is over the set threshold. This Research is part of *Pasture, Forage and Range Land Systems,* an ARS national program (#215).

Beneficial Insects

In conjunction with the Department of Homeland Security,Science and Technology Directorate, Rio Grande Valley Water Districts, and ARS researchers, a biological control program is being conducted to target the invasive weed *Arundo donax* L., also known as carrizo cane or giant reed. *Arundo donax* is an invasive weed of the Rio Grande River Basin. It dominates these habitats, which leads to catastrophic stream bank erosion and consumption of vital water resources. *Arundo donax* is a good target for biological control because it has no close relatives in North or South America and several of the plant-feeding insects from its native range in Europe are known to feed only on this one plant species. ARS is partnering with APHIS to mass rear and applies these insects at a pilot study site near Laredo, Texas. This Research is part of *Veterinary, Medical, and Urban Entomology,* an ARS national program (#104).

Measuring Rangeland Health

Knowing the health status of the country's rangeland is needed if these unique and valuable ecosystems are to be maintained. However, monitoring rangeland health can be time consuming and expensive. ARS researchers in conjunction with the USDA Natural Resources Conservation Service (NRCS), have developed protocols for measuring rangeland health that take 38% less time and provide higher data quality. These methods are now being used by NRCS to monitor approximately 400 million acres of rangelands in the continental US. This Research is part of *Pasture, Forage and Range Land Systems,* an ARS national program (#215).

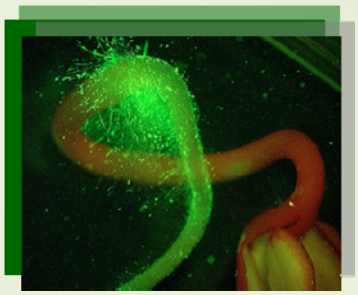
ARS Downstream Outcomes

FOOD SAFETY AND NUTRITION

- 115 Research Projects
- 25 Locations
- 300 Scientists

Foodborne Pathogens

Methods that rapidly confirm the identification of foodborne pathogens are highly desired. ARS researchers developed the (MIT) 1000 Rapid Microbial Identification (RMID) System, an instrument that detects laser light scattered from individual bacterial cells. Identification times are less than 10 min and operating costs are extremely low. The MIT RMID was evaluated for identification of *Listeria spp*. *Listeria* are common environmental microorganisms and one species, *L. monocytogenes*, is a leading cause of death among foodborne pathogenic bacteria. Under an AOAC RI Evaluation Test Protocol, a total of 55 microbial isolates were tested of which 25 were *Listeria* spp. and 30 were a variety of other bacterial species. The system identified each of the strains of *Listeria* and each strain of other bacterial species was properly reported as unknown (overall accuracy of 99%). This Research is part of *Food Safety,* an ARS national program (#108).



Dietary Supplement Ingredient Database

During the last decade over half of American adults reported taking at least one dietary supplement in the National Health and Nutrition Examination Survey (NHANES), and many supplements contribute nutrients and other components to dietary intake. ARS scientists worked with the Office of Dietary Supplements, National Institutes of Health (ODS/NIH) and other federal agencies to plan and develop a Dietary Supplement Ingredient Database (DSID). The DSID provides estimated ingredient levels for generic products derived from analyzed nutrient levels in a representative group of adult multivitamin/minerals (MVMs) consumed in the U.S. The DSID, First Release (DSID-1) was made available to researchers and the public on April 20, (2009) http://dietarysupplementdatabase.usda.nih.gov. This web site provides a user-friendly interface for the DSID and was developed through an iterative process between NDL scientists and web development specialists. The web site is hosted by the National Library of Medicine (NLM). The consortium of federal agencies includes ODS and partners at

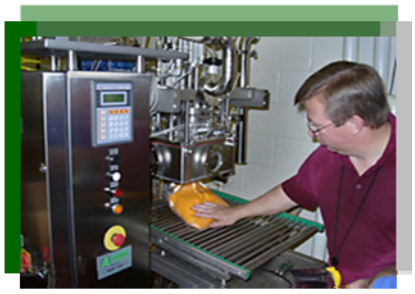
USDA/ARS, the National Center for Health Statistics of the Centers for Disease Control and Prevention (NCHS/CDC), The Food and Drug Administration (FDA) , the National Cancer Institute (NCI), NIH, and the National Institute of Standards and Technology (NIST) of the Department of Commerce. This Research is part of *Human Nutrition,* an ARS national program (#107).

Methods for Detection on Important Non-O157 Shiga toxin-Producing *Escherichia coli*

Non-pathogenic strains of *Escherichia coli* bacteria are normal inhabitants of the gastrointestinal tract of humans and animals and normally do not cause illness. However, many strains of *E. coli* can induce serious gastrointestinal diseases and even death in humans. *E. coli* belonging to a serotype known as O157:H7 (serogroup O157) is an important food-borne pathogen responsible for outbreaks of hemorrhagic colitis and hemolytic uremic syndrome, the leading cause of acute renal failure in children. Cattle are the most important reservoir for *E. coli* O157:H7, and ground beef and raw milk have been implicated in many outbreaks and sporadic cases of disease. *E. coli* O157:H7 strains are also known as Shiga toxin-producing *E. coli* (STEC) because they produce one or more types of Shiga toxins, which are involved in the disease process. In recent years, it has become evident that other *E. coli* serogroups including O26 and O111 also produce Shiga toxins and cause a similar illness in humans as *E. coli* O157:H7. At the request of the Food Safety and Inspection Service (FSIS), methods were developed by ARS scientists to detect these non-O157 STEC in beef, and potentially in other foods, as well. The methods involve enrichment in a growth medium suitable for increasing the numbers of *E. coli* in beef samples followed by a technique known as real-time multiplex polymerase chain reaction (PCR). The technique allows amplification of DNA sequences specific for the non-O157 STEC strains, and detection of the amplified products is accomplished in real-time because fluorescent labeled probes specific for the amplified products are used in the PCR assay. This research is part of *Food Safety,* an ARS national program (#108).

Continuous Sterilization

ARS researchers and collaborators at North Carolina State University (NCSU) and Industrial Microwave Systems (IMS), the NCSU-ARS-IMS Microwave Technology Team, developed the first process for continuous sterilization of highly viscous sweet potato puree and other vegetable or fruit purees so they may be aseptically filled in pre-sterilized pouches or bags up to 300 gallons in size. This process results in sweet potato puree with excellent retention of β-carotene (90%) and other nutrients, a bright orange color similar to fresh sweet potatoes, and a typical sweet potato flavor. This puree may be stored at room temperature for over a year with retention of color and viscosity comparable to that of freshly made puree. For purple-fleshed sweet potato purees, microwave-assisted aseptic processing resulted in high anthocyanin retention (85%). In a food processing operation, the bags of puree can be cut open and the puree emptied into a vat for transfer into products. This Research is part of *Quality and Utilization of Agricultural Products,* an ARS national program (#306).



DOWNSTREAM OUTCOMES FROM FS TECHNOLOGY TRANSFER ACTIVITIES

Biofuel Production from Woody Biomass

A major barrier to the commercial development of fuels and products from woody biomass has been addressed thanks to a joint research effort between the U.S. Forest Service's Forest Products Laboratory (FPL) and the University of Wisconsin-Madison (UW). FPL and UW researchers have developed a novel process that helps overcome the natural resistance of biomass to enzymatic deconstruction. Processes that can efficiently convert woody biomass to ethanol are lacking due in part to what is referred to as cellulose recalcitrance - the inability to efficiently convert cellulose to glucose - a necessary step in ethanol production. The newly developed process is a sulfite pretreatment to overcome recalcitrance of lignocellulose, or SPORL.

Brown-rot Fungus Genetic Code

An international team led by scientists from the U.S. Forest Service's Forest Products Laboratory and U.S. Department of Energy (DOE) Joint Genome Institute (JGI) have translated the genetic code of the complex biochemical machinery that makes brown-rot fungi uniquely destructive to wood. The mechanisms by which these fungi gain access to energy-rich sugar molecules in wood may ultimately lead to innovations for the biofuels industry. The research, conducted by more than 50 authors, is reported in the Feb. 4 edition of the *Proceedings of the National Academy of Sciences*. The paper describes analysis of the *Postia placenta* genome and reports a milestone in understanding lignocellulose conversions.

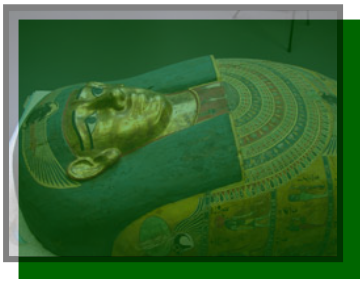
Recommendations to Major League Baseball

During the 2008 Major League Baseball season, 2,232 wooden baseball bats broke between early July and late September, a potentially harmful problem. Much of the discussion over "why" this was happening centered on the use of maple bats. Dave Kretschmann, a research engineer at the U.S. Forest Service's Forest Products Laboratory, led a group to look at what could be done to make wooden bats safer for players and fans alike. The group discovered that the majority of multiple-piece failures were caused by a severe slope of wood grain. Essentially, the grain pattern for maple is more difficult to

discern than ash, making it harder for manufacturers to grade it properly and process it so the grain is oriented properly. Kretschmann and his group compiled nine recommendations to reduce the frequency of multi-piece bat failures to Major League Baseball's Safety and Health Advisory Committee. The committee and the Major League Baseball Players Association announced on Dec. 9, 2008 at their winter meetings in Las Vegas they have adopted the group's recommendation.

Ancient Art Inspection

The U.S. Forest Service's Forest Products Laboratory researchers recently put their wood condition assessment skills to use on an unusual subject: the coffin of Meretites, an Egyptian noblewoman. Acquired by the Nelson–Atkins Museum of Art in Kansas City, Missouri, the coffin is part of a 2,500-year-old assemblage of funerary objects that also includes a gilded mask, statuettes of Isis and Nephthys, and 306 figurines known as shabtis. FPL researchers were called upon for their expertise in determining the condition of wood without damaging it. Scientists were able to transmit sound waves through the wooden coffin and determine if decay was present by measuring the speed of the waves. The testing revealed that the upper section of the coffin was in excellent condition and that there was an area on the lower section that warrants further investigation based on evidence of deterioration.



Addendum 1

ARS TECHNOLOGY TRANSFER AWARD WINNERS

2009 ARS Technology Transfer Awards

Scientists: Dr. Matias B. Vanotti et al, South Atlantic Area
Title: Second Generation Treatment System for the Green and Profitable Management of Livestock Manure
Citation: For developing of a green and profitable manure treatment technology
Award: ARS Outstanding Award

Scientists: Dr. Steven Lehotay et al, North Atlantic Area
Title: Partners in QuEChERS
Citation: For developing technology transfer activities to countless laboratories worldwide that use the QuEChERS approach to monitor pesticides and other residues in foods
Award: ARS Outstanding Award

Scientists: Dr. George E. Inglett, Midwest Area
Title: Development of Z-Trim
Citation: For outstanding accomplishments in the invention and technology transfer of the multi-functional food ingredient Z-Trim which contributes to healthier foods for people around the world.
Award: ARS Superior Award

Scientists: Dr. Chad Finn, Pacific West Area
Title: New Berry Cultivars
Citation: For development and transfer of new varieties of berries.
Award: ARS Superior Award

Scientists: Dr. Van Den Truong et al, South Atlantic Area
Title: NCSU-ARS-IMS Microwave Technology Team
Citation: For development and transfer of a novel continuous flow microwave heating process for producing large containers of aseptic shelf-stable vegetable and fruit purees.
Award: ARS Superior Award

Scientists: Dr. Kenneth J. Linthicum et al, South Atlantic Area
Title: Rift Valley Fever Outbreak Early-Warning Team
Citation: For outstanding effort and creativity in the development and transfer of Rift Valley fever outbreak early-warning system to protect global agriculture and public health.
Award: ARS Superior Award, and South Atlantic Area Technology Transfer Award

Scientists: Dr. Anna Myers McClung, Southern Plains Area
Title: Rice Cultivar Development
Citation: For development of eight rice varieties resulting in new and improved processed foods, capture of value-added markets, and expansion of the organic rice industry.
Award: ARS Superior Award

Scientists: Dr. E. Raymond Hunt, Jr.
Title: UAV Remote Sensing
Citation: For developing of new sensor technology which enables low-cost remote sensing using unmanned airborne vehicles for agricultural and natural resource management.
Award: Beltsville Area Technology Transfer Award

Scientists: Dr. Agnes M. Rimando
Title: Psterostilbene Technology
Citation: For developing and transferring of technology and information regarding the health benefits of pterostilbene.
Award: Mid South Area Technology Transfer Award

Scientists: Dr. Xiaoliang Cui
Title: Cotton Properties
Citation: For outstanding efforts in transferring to China the USDA process for classifying and measuring the properties of cotton, who now require the use of such.
Award: Mid South Area Technology Transfer Award

Scientists: Dr. Phillip H. Klesius et al
Title: Streptococcal Vaccine Team
Citation: For developing novel *Streptococcus iniae* and *S. agalactiae* vaccines for prevention of the two most important devastating diseases of cultured and wild fish.
Award: Mid South Area Technology Transfer Award

Scientists: Dr. Joseph Laszlo et al
Title: New Crops and Processing Team
Citation: For evaluating and converting of Soyscreen in an Oil-based Formulation for UV Protection of *Beauveria bassiana* Conidia.
Award: Midwest Area Technology Transfer Award

Scientists: Dr. Matias B. Vanotti et al
Title: Second Generation Treatment System for the Green and Profitable Management of Livestock Manure
Citation: For developing of a green and profitable manure treatment technology
Award: South Atlantic Area Technology Transfer Award

Scientists: Dr. Van Den Truong et al
Title: NCSU-ARS-IMS Microwave Technology Team
Citation: For development and transfer of a novel continuous flow microwave heating process for producing large containers of aseptic shelf-stable vegetable and fruit purees.

2009 Federal Laboratories Consortium (FLC) Awards

***Scientist*:** Dr. Curtis Van Tassell et al, Bovine Functional Genomics Laboratory, Beltsville Area
***Title*:** Development and Commercialization of a DNA Assay for Cattle
***Citation*:** For developing a fiber optic beadchip that specifically assay single nucleotide polymorphism (SNP) DNA markers from over 58,000 locations distributed across the bovine genome
Award: National Excellence in Technology Transfer

***Scientists*:** Dr. Renfu Lu et al; Sugarbeet and Bean Research Unit, East Lansing, MI
***Title*:** Novel ARS Processes for Bleaching, Biopolishing, and Shrinkproofing Wool
***Citation*:** For inventing a novel process for bleaching, biopolishing, and shrinkproofing wool
Award: National Excellence in Technology Transfer

***Scientists*:** Dr. Jeanette Cardamone; Fats, Oils and Animal Coproducts Research Unit, North Atlantic Area
***Title*:** Hyperspectral Imagine for Food quality and Safety Inspection
***Citation*:** For inspecting technology that offers unique, superior capabilities over conventional imaging and spectroscopy, two widely used technologies for food quality and safety inspection
Award: National Excellence in Technology Transfer

***Scientist*:** Dr. Paul C. Doraiswamy, Hydrology and Remote Sensing Laboratory, Beltsville Area
***Title*:** Development of an Operational System for Regional Crop Production Assessment
***Citation*:** For developing of satellite imagery-based technology for operational prediction of local and regional crop yields and adapted by USDA NASS for domestic crop production assessment
Award: Mid-Atlantic Region Excellence in Technology Transfer

Scientists: Joanne M. Holden et al; Nutrient Data Laboratory (NDL), Beltsville Human Nutrition Research Center (BHNRC), Beltsville Area
Title: Dietary Supplement Ingredient Database
Citation: For developing a Dietary Supplement Ingredient Databases (DSID) to estimate levels of ingredients in dietary supplement products
Award: Mid-Atlantic Region Excellence in Technology Transfer

Scientists: Dr. Fumiomi Takeda et al; Appalachian Fruit Research Station, North Atlantic Area
Title: Commercialization of the Rotatable Cross-Arm Trellis
Citation: For developing of a rotatable cross-arm (RCA) trellis and blackberry cane training technique to improve commercial blackberry production
Award: Mid-Atlantic Region Excellence in Technology Transfer

Scientists: Dr. Steven J. Lehotay et al; Microbial Biophysics and Residue Chemistry Research, North Atlantic Area
Title: Partners in QuEChERS
Citation: For developing technology transfer activities to countless laboratories worldwide that use the QuEChERS approach to monitor pesticides and other residues in foods
Award: Mid-Atlantic Region Excellence in Technology Transfer

Scientists: Dr. Joseph Laszlo and Dr. David Compton, New Crops and Processing, Midwest Area
Title: New Crops and Processing Team
Citation: For evaluating and converting of Soyscreen in an Oil-based Formulation for UV Protection of Beauveria bassiana Conidia
Award: Midwest Region Excellence in Technology Transfer

Scientists: D. Andy King et al; Meat Safety and Quality Research, U.S. Meat Animal Research Center, Northern Plains Area
Title: Beef Muscle Utilization Group
Citation: For exemplary efforts to assist the U.S. beef industry with implementation of highly palatable, low-cost alternative beef steak items
Award: Mid-Continent Region Notable Technology Development

Scientists: Dr. James Mahan et al; Cropping Systems Research Laboratory, Southern Plains Area
Title: BIOTIC – Smart Crop-USDA
Citation: For developing a novel method and device, named BIOTIC, to manage the irrigation of plants using crop canopy temperature measurements
Award: Mid-Continent Region Excellence in Technology Transfer

Addendum 2

World-Wide Distribution of Plant Germplasm

The National Genetic Resources Program (NGRP) is responsible for acquiring, characterizing, preserving, documenting, and distributing to scientists, germplasm of all life forms important for food and agricultural production. With NGRP, the Germplasm Resources Information Network (GRIN) provides germplasm information about plants, animals, microbes and invertebrates. In 2009, GRIN distributed from 27 repositories over 140,000 accessions throughout the world. See table and map below for detailed distribution information.

	No. of germplasm accessions (specimens) by Recipient category[2]											
Repository[1]	UARS	UFED	STA	UCOM	UPRU	UIND	INT	FGEN	FCOM	FPRU	FIND	Total
BRW	0	0	0	0	0	0	0	0	0	0	0	0
COR	163	0	0	0	0	0	0	0	0	0	0	163
COT	137	13	731	138	18	189	0	0	317	3	0	1546
DAV	132	0	273	994	215	2824	0	102	5	571	41	5157
FLAX	0	0	0	0	0	0	0	0	0	0	0	0
GEN	234	0	353	497	237	1964	0	0	0	155	0	3440
GSOR	1928	0	69	29	4	31	36	0	4	62	0	2163
GSPI	0	0	15	3	40	7	0	0	0	1	0	66
GSZE	0	0	0	0	0	0	0	0	0	0	0	0
HILO	0	0	0	0	0	0	0	0	0	0	0	0
MAY	8	1	37	39	19	87	0	0	0	1	0	192
MIA	45	3	47	12	28	9	0	0	6	21	0	171
NA	2	0	25	1	2	7	0	0	4	19	0	60
NC7	2712	34	3840	3379	648	1894	0	102	1316	1998	157	16080
NE9	101	20	458	366	81	780	0	51	198	351	1	2407
NR6	455	0	643	201	68	530	7	0	28	439	10	2381
NSGC	12978	2	4398	2870	461	1300	386	900	277	6121	55	29748
NSSL	19	0	2	40	11	20	0	0	2	190	14	298
OPGC	17	0	41	65	4	16	0	0	15	0	0	158
PALM	8	0	5	48	11	14	0	0	0	0	0	86
PARL	13	99	75	96	10	13	0	0	0	4	0	310
RIV	0	0	0	0	0	0	0	0	0	0	0	0
S9	2616	19	11986	3988	680	1169	0	95	2732	480	87	23852
SOY	16399	0	4203	2922	131	176	0	8391	50	549	0	32821
TGRC	0	0	0	0	0	0	0	0	0	0	0	0
TOB	0	0	0	0	0	0	0	0	0	0	0	0
W6	1901	58	3374	1649	222	787	2281	372	1689	6686	108	19127
Total	39868	249	30575	17337	2890	11817	2710	10013	6643	17651	473	140226

Footnotes to Table

[1]BRW, Natl. Germplasm Repository – Brownwood; CLO, Clover collection; COR, Natl. Germplasm Repository – Corvallis; COT, Cotton Collection; DAV, Natl. Germplasm Repository – Davis; DLEG, Desert Legume Program; FRA , Pawpaw Satellite Site - Natl Clonal Repository, Corvallis; GEN, Natl. Germplasm Repository – Geneva; GSOR, Rice Genetic Stock Center; GSPI, Pea Genetic Stock Collection; GSZE, Maize Genetic Stock Center; HILO, Natl. Germplasm Repository – Hilo; MAY, Natl. Germplasm Repository – Mayaguez; MIA, Natl. Germplasm Repository – Miami; NA, National Arboretum; NC7, North Central Regional PI Station; NE9, Northeast Regional PI Station; NGRL, National Germplasm Resources Laboratory; NR6, Potato Germplasm Introduction Station; NSGC, National Small Grains Collection; NSSL, National Center for Genetic Resources Preservation; NTSL, Forest Service National Seed Lab; OPGC, Ornamental Plant Germplasm Center; PALM, National Arctic Plant Genetic Resources Unit; PARL, National Arid Land Plant Genetic Resources Unit; PEO, Plant Exchange Office; PIO, Plant Introduction Office; RIV, Natl. Germplasm Repository – Riverside; S9, Southern Regional PI Station; SOY, Soybean Collection; TGRC, C.M. Rick Tomato Genetics Resource Center; TOB, Nicotiana Collection; and W6, Western Regional PI Station.

[2] FCOM, foreign commercial companies; FGEN, foreign genebank or resources units; FIND, foreign individuals with affiliations; FPRU, foreign non-commercial organization; INT, CGIAR International Agricultural Research Centers; STA U.S. state agencies or universities; UAID, U.S. Agency for International Development; UARS, Agricultural Research Service; UCOM, U.S. commercial companies; UFED, U.S. Federal agency not ARS or AID; UNID, U.S. individuals with no affiliation; and UPRU, U.S. non-profit organizations.

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