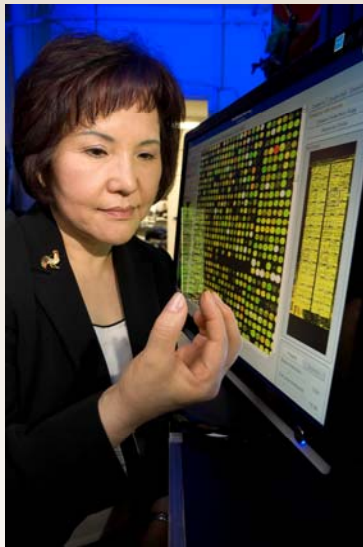




**U. S. DEPARTMENT OF AGRICULTURE
ANNUAL REPORTING ON TECHNOLOGY TRANSFER
FY 2008**



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U.S. Department of Agriculture (USDA)

Annual Reporting on Agency Technology Transfer¹

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 also includes tabular metrics of inventions, licenses, and Cooperative Research and Development Agreements for the Forest Service.

Agricultural Research Service (ARS)

Mission Statement

ARS conducts research to develop and transfer solutions to agricultural problems of high national priority to:

- ensure a high-quality, safe, abundant food supply;
- assess the nutritional needs of Americans;
- sustain a competitive agricultural economy;
- enhance U.S. natural resources and the environment; and to
- 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 approximately 2100 permanent full-time scientists who conduct research in projects funded by Congressional appropriations at more than 100 locations. Research projects are grouped into 21 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.

¹Prepared 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 is responsible for protecting and promoting U.S. agricultural health, administering the Animal Welfare Act, and carrying out wildlife damage management activities. The 2003-2008 APHIS Strategic Plan indicates that for wildlife issues, programs will be expanded in the areas of wildlife disease and invasive species control, with increased emphasis on research in these areas. APHIS and its stakeholders have become aware of the need to pay more attention to wildlife diseases—particularly those that are transmissible to humans and domestic livestock—and invasive species that impact ecosystems. APHIS's National Wildlife Research Center in Ft. Collins, CO will continue to expand its research into these areas. This research has important implications for APHIS emergency preparedness initiatives. APHIS will continue to partner with the Federal Aviation Administration to work with managers of the country's airports to minimize the risks wildlife pose to public safety and the aviation industry.

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 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 point of contact and liaison for scientists conducting research within APHIS-WS.

Technology transfer is accomplished through many mechanisms, such as:

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

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 that 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 made available to OTT management in FY 2008 for use in fine-tuning research partnerships.

OTT now has fully functional 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 has been expanded by adding two new modules for tracking plant materials and biological material inventions. The Biological Materials Inventions module 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 that annual metrics can be obtained for each NP and 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 302 licenses in force, 40% 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 three percent of licenses are with small businesses, and 19% with large businesses, including foreign multinationals with major U.S. presence. Of 27 licenses executed in FY 2008, 41% were with universities and 52% were with small businesses; four were start-ups based on ARS technologies.

It became clear during 2008 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 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 has 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 perhaps 6-8 PIAs across the United States would increase opportunities for businesses – through the intermediary – to gain access to the 2100 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 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 its first Partnership Intermediary Agreement with the Maryland Technology Development Corporation (TEDCO). During the year, TEDCO funded a Maryland licensee (start-up company) of a technology from the Southern Regional Research Center in New Orleans, and three CRADA partners. On October 30, 2008, TEDCO and ARS co-hosted a Green Technologies Showcase highlighting technologies and research capacities of scientists across the agency. From that event, several new partnerships are pending. ARS entered into a second PIA with the Mississippi Technology Alliance (MTA), in December 2008.

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 2008:

- 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 the agricultural industries. Shows are selected in part on the types and number of technologies in a particular area needing private sector partners for commercialization.
- The ARS-OTT Technology Alerts continues to expand its membership in 2008. Strategic marketing plans continue 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. The list now includes technologies specific for: Animal Production (Swine, Cattle, Aquaculture, Poultry, Other Animals—every other animal, e.g. deer, sheep); Food, Safety and Nutrition; Biobased Products/Biofuels; Natural Resources; Biotechnology; and Crop Production (Corn, Cotton, Soybean, Wheat, Other Crops—such as switchgrass and blueberries). Technology Alert customers may subscribe to one or more of these options.
- Given the increased emphasis during FY 2008 on sustainable energy and reducing the national reliance on petroleum, ARS is redefining and expanding research on bioenergy. The new National Program (213) 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 2008 specifically addressing the technology transfer processes necessary to enhance bioenergy research outcomes. OTT also has designed a new public exhibition module on this topic in collaboration with the ARS Information Staff.

- In July 2008 the Midwest Area (MWA) convened a Bioenergy Forum at the National Center for Agricultural Utilization Research (NCAUR) in Peoria, IL. More than 150 people attended the event, which was designed to seek new customer partnerships and strengthen existing stakeholder relationships. Attendees and presenters included ARS and university scientists, business owners and entrepreneurs, economic development organizations, and community leaders represented by state and federal officials. Media representatives from trade publications, local print, radio and three network affiliates attended and reported positively on the event. Presentations on partnering with ARS resulted in a number of new research partnerships and other initiatives.
- OTT also serves the USDA Energy Council established in FY 2006 to enhance coordination of research and technology transfer efforts in bioenergy and biobased products toward the goal of reducing reliance on petroleum and petroleum-based products. OTT is taking a leadership role in helping to expand research opportunities with the private sector toward this important national goal. In FY 2008, ARS signed a Memorandum of Understanding with the Department of Energy (DOE) to allow ARS scientists to participate with researchers who are part of the three Bioenergy Research Centers (BRC) established with funds from DOE. Because BRCs manage intellectual property under statutes and policies different from that of USDA, it was necessary to negotiate IP management practices when ARS scientists are co-inventors or sole inventors during the performance of cooperative research. Similarly, because OTT also manages IP from Forest Service researchers, OTT negotiated a similar MOU to be signed by the Forest Service and DOE.
- 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 Forest Service's Forest Product Laboratory in Madison, WI. Further discussions were held at ARS and FS headquarters. Subsequently, an expanded Forest Service and ARS joint program in bioenergy research was agreed upon, and the resultant Memorandum of Understanding between ARS and Forest Service is anticipated to be executed early in calendar year 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 DOE.
- 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, 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, pseudorabies).

- The five agency Patent Committees were realigned in FY 2007 to form three national committees by discipline/subject matter to minimize time between submission and review, and to improve consistency of decisions across the agency. These new committees were instituted on October 1, 2007 (FY 2008).
- In FY 2008, OTT and the Office of National Programs released an electronic *ARS Handbook for Plant Breeders* that provides advice to ARS researchers in the National Program on Plant Genetic Resources, Genomics and Genetic Improvement (NP #301). The handbook describes ARS policies and procedures related to release and technology transfer of plant germplasm. It also covers how to use the ARIS Plant Materials module and provides guidance on ARS management decisions on plant IP issues.
- 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), and the National Agriculture Library at BARC. In calendar year 2009, solicitations for interested parties will be published and selection of tenants is anticipated. Such tenants at BARC would be required to develop formal partnerships with researchers at ARS (CRADAs), or licensing agreements to commercialize ARS research outcomes that produced protectable IP. In combination with Partnership Intermediary Agreements, EUL may aid in developing long-term partnerships with the private sector.

Collaborative Relationships for Research & Development (R&D)

CRADAs and Other R&D

Agricultural Research Service (ARS)	FY 2004	FY 2005	FY 2006 ¹	FY 2007	FY 2008
• CRADAs, total active in the FY	205	199	185	207	230
- New, executed in the FY	44	55	50	55	69
▪ Traditional CRADAs, total active in the FY	185	171	163	184	202
- New, executed in the FY	36	45	40	47	63
▪ Non-traditional CRADAs, total active in FY	20	28	22	23	28
- New, executed in the FY	8	11	10	8	6
▪ Material Transfer - CRADA, total active in the FY	4	6	7	5	3
- New, executed in the FY	0	3	2	2	1
▪ Master, total active in the FY	2	1	1	1	1
- New, executed in the FY	1	0	0	0	0
▪ Multiple Cooperators, total active in the FY	9	17	7	10	12
- New, executed in the FY	3	4	1	3	3
▪ Foreign - CRADA, total active in the FY	5	9	7	7	12
- New, executed in the FY	3	4	2	3	2
• Amendments², total in the FY	67	70	73	77	76
• Other collaborative R&D relationships, total active in the FY³					
▪ Confidentiality Agreements					
- New, executed in the FY	162	242	227	329	270
▪ Material Transfer Agreements					
- New, executed in the FY	498	722 ⁴	700 ⁵	788 ⁶	884 ⁷
▪ Other Agreements, total active in the FY	1,166	5,028	3,477	4,084	5,466
- New, executed in the FY	741	722	676	1,159	1,729
• Animal and Plant Health Inspection Service (APHIS)					
▪ CRADAs, total active in the FY	N/A	N/A	2	3	3
- New, executed in the FY	N/A	N/A	2	1	0
▪ Material Transfer - CRADA, total active in the FY	N/A	N/A	1	7	10
- New, executed in the FY	N/A	N/A	N/A	6	3
▪ Confidentiality Agreements	N/A	N/A	N/A	12	16
- New, executed in the FY	N/A	N/A	N/A	4	4
• Forest Service (FS)					
▪ CRADAs, total active in the FY	N/A	N/A	8	20	19
- New, executed in the FY	N/A	N/A	5	13	7

¹ Data for 2006 from APHIS and FS were originally reported with ARS CRADA data. The APHIS and FS data is now separate and reflected in rows identified for their respective Agency.

² Amendments extend existing CRADAs for additional years to a maximum of 5 years, and/or change Statements of Work, and/or change funding levels.

³ Includes Trust Fund Agreements, Reimbursable Agreements, and Non-Funded Cooperative Agreements; data incomplete for FY 2004.

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.

Invention Disclosure and Patenting

Intellectual Property Management ¹

Agricultural Research Service (ARS)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
● New invention disclosures in the FY	142	125	105	124	133
● Patent applications filed in the FY	81	88	83	107	114
▪ Non-Provisional	59	62	59	68	74
▪ Provisional	22	26	24	39	40
● Patents issued in the FY	50	27	39	35	27

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

Forest Service (FS)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
● New invention disclosures in the FY	N/A	N/A	N/A	2	0
● Patent applications filed in the FY	N/A	N/A	N/A	7	9
▪ Non-Provisional	N/A	N/A	N/A	5	5
▪ Provisional	N/A	N/A	N/A	2	4
● Patents issued in the FY	N/A	N/A	N/A	2	3

Licensing

Profile of Active Licenses ¹

Agricultural Research Service (ARS)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
● All licenses, number total active in the FY	296	320	332	327	315
▫ New, executed in the FY	29	33	25	25	27
▪ Invention licenses, total active in the FY	296	320	332	327	315
▫ New, executed in the FY	29	33	25	25	27
- Patent licenses, total active in FY	290	309	316	327	291
▫ New, executed in the FY	24	28	20	24	23
- Material transfer (invention), total active in FY	6	11	16	22	24
▫ New, executed in the FY	5	5	5	5	4

¹ "Active" means legally in force at any time during the FY, whether or not the license is income 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 2006. Data for FY 2004 was corrected for typographical errors.

Forest Service (FS)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
● All licenses, number total active in the FY	N/A	N/A	N/A	12	13
▫ New, executed in the FY	N/A	N/A	N/A	0	1
▪ Invention licenses, total active in the FY	N/A	N/A	N/A	12	13
▫ New, executed in the FY	N/A	N/A	N/A	0	1

Income Bearing Licenses¹

Agricultural Research Service (ARS)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
• All income bearing licenses, number	294	318	330	337	313
▫ Exclusive	200	220	233	241	223
▫ Partially exclusive	41	37	32	24	20
▫ Non-exclusive	53	61	65	72	70
• Invention licenses, income bearing	294	318	330	337	313
▫ Exclusive	200	220	233	241	223
▫ Partially exclusive	41	37	32	24	20
▫ Non-exclusive	53	61	65	72	70
- Patent licenses, income bearing	288	307	314	315	289
▫ Exclusive	200	220	233	238	220
▫ Partially exclusive	41	37	32	24	20
▫ Non-exclusive	47	50	49	53	49
- Material transfer (invention) licenses, income bearing	6	11	16	22	24
▫ Exclusive	0	0	0	3	3
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	6	11	16	19	21
• All royalty bearing licenses, number²	82	99	100	106	112
• Invention licenses, royalty bearing	82	99	100	106	112
- Patent licenses, royalty bearing	82	96	93	101	104
- Material transfer (invention) licenses, royalty bearing	1	3	7	5	8

¹ Includes data from FS.

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

Licensing Management

Agricultural Research Service (ARS)	FY 2004⁵	FY 2005⁴	FY 2006³	FY 2007²	FY 2008¹
• Number of licenses					
▪ Invention licenses , total active in the FY	296	320	332	339	315
▫ New, executed in the FY	29	33	25	25	27
• Elapsed execution time , licenses granted in the FY					
▪ Invention licenses					
▫ average (months)	7.1	5.5	11.2	8.9	4.8
▫ median (months)	6.8	3.5	7.6	8.2	5.0
▫ minimum (months)	3.5	1.1	2.3	2.6	0.5
▫ maximum (months)	13.1	21.7	27.7	23.7	11.4
- Exclusive and partially exclusive invention licenses					
▫ average (months)	8.7	4.3	14.3	11.6	7.3
▫ median (months)	8.0	3.9	15.0	9.3	6.6
▫ minimum (months)	6.8	1.1	3.9	3.0	3.9
▫ maximum (months)	13.1	9.2	27.7	23.7	11.4
- Non-exclusive invention licenses					
▫ average (months)	6.2	6.8	6.7	6.9	2.3
▫ median (months)	6.0	2.9	5.9	8.2	1.0
▫ minimum (months)	3.5	1.7	2.3	2.6	0.5
▫ maximum (months)	11.5	21.7	12.1	11.5	6.0
▪ Patent invention licenses					
▫ average (months)	8.2	6.1	12.1	9.6	7.2
▫ median (months)	7.5	3.9	7.6	7.2	6.0
▫ minimum (months)	3.5	1.1	2.3	2.6	3.9
▫ maximum (months)	13.1	21.7	27.7	23.7	11.4
- Exclusive and partially exclusive patent invention licenses					
▫ average (months)	8.7	4.3	14.3	11.6	7.3
▫ median (months)	8.0	3.9	15.0	9.3	6.6
▫ minimum (months)	6.8	1.1	3.9	3.0	3.9
▫ maximum (months)	13.1	9.2	27.7	23.7	11.4
- Non-exclusive patent invention licenses					
▫ average (months)	7.8	8.6	4.8	6.5	6.0
▫ median (months)	7.1	5.8	5.9	6.4	6.0
▫ minimum (months)	3.5	2.6	2.3	2.6	6.0
▫ maximum (months)	11.5	21.7	6.3	11.5	6.0
▪ Material transfer (invention) licenses					
▫ average (months)	4.4	2.3	8.2	7.3	1.8
▫ median (months)	4.0	2.3	8.4	9.2	0.6
▫ minimum (months)	3.6	1.7	3.9	3.0	0.5
▫ maximum (months)	6.0	2.9	12.1	9.2	5.8
- Non-exclusive material transfer (invention) licenses					
▫ average (months)	4.4	2.3	8.2	7.3	1.8
▫ median (months)	4.0	2.3	8.4	9.2	0.6
▫ minimum (months)	3.6	1.7	3.9	3.0	0.5
▫ maximum (months)	6.0	2.9	12.1	9.2	5.8
• Licenses terminated for cause , in the FY					
▪ Invention licenses	1	0	0	0	0
▪ Patent invention licenses	1	0	0	0	0
▪ Material transfer (invention) licenses	0	0	0	0	0

Footnotes to table provided on next page.

¹ 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.

² 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.

³ 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.

⁴ 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.

⁵ Based on 17 licenses granted. The elapsed execution time data presented 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. Records for which license applications were received prior to October 1, 2000 also were not included, because ARS did not track this data prior to FY 2001.

License Income ¹

Agricultural Research Service (ARS)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
• Total income , all patent invention licenses active in the FY	\$2,163,507	\$3,315,486	\$3,161,869	\$3,588,148	\$3,953,415
• Invention licenses	\$2,163,507	\$3,315,486	\$3,161,869	\$3,588,148	\$3,953,415
- Patent licenses	\$2,140,466	\$3,302,371	\$3,100,219	\$3,521,739	\$3,883,922
- Material transfer (invention licenses)	\$23,041	\$13,115	\$61,650	\$46,409	\$69,493
• Other IP Licenses	\$0	\$0	\$0	\$0	\$0
• Total Earned Royalty Income (ERI)	\$1,426,876	\$2,089,174	\$2,337,323	\$2,681,552	\$3,009,774
▫ Median ERI	\$5,645	\$5,325	\$5,000	\$4,657	\$4,258
▫ Minimum ERI	\$124	\$49	\$18	\$12	\$7
▫ Maximum ERI	\$154,213	\$263,648	\$230,296	\$388,730	\$761,553
▫ 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	\$499,709	\$890,414	\$908,123	\$1,230,251	\$1,657,059
▫ ERI from top 20% of licenses	\$1,026,141	\$1,647,700	\$1,879,229	\$2,205,066	\$2,543,565
• Invention licenses, total ERI	\$1,426,876	\$2,089,174	\$2,337,323	\$2,681,552	\$3,009,774
▫ Median ERI	\$5,645	\$5,325	\$5,000	\$4,657	\$4,258
▫ Minimum ERI	\$124	\$49	\$18	\$12	\$7
▫ Maximum ERI	\$154,213	\$263,648	\$230,296	\$388,730	\$761,553
▫ 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	\$499,709	\$890,414	\$908,123	\$1,230,251	\$1,657,059
▫ ERI from top 20% of licenses	\$1,026,141	\$1,647,700	\$1,879,229	\$2,205,066	\$2,543,565
- Patent (and patent application) licenses, total ERI	\$1,423,835	\$2,083,059	\$2,301,172	\$2,662,122	\$2,982,281
▫ Median ERI	\$6,870	\$5,601	\$5,194	\$4,662	\$4,579
▫ Minimum ERI	\$124	\$49	\$18	\$89	\$45
▫ Maximum ERI	\$154,213	\$263,648	\$230,296	\$388,730	\$761,553
▫ 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	\$499,709	\$890,414	\$908,123	\$1,230,251	\$1,544,031
▫ ERI from top 20% of licenses	\$1,002,660	\$1,624,258	\$1,854,214	\$2,178,046	\$2,485,319
- Material transfer (invention licenses), total ERI	\$3,041	\$6,115	\$36,150	\$19,430	\$27,493
▫ Median ERI	\$3,041	\$1,925	\$2,645	\$3,428	\$1,003
▫ Minimum ERI	\$3,041	\$600	\$153	\$12	\$7
▫ Maximum ERI	\$3,041	\$3,591	\$17,053	\$9,784	\$9,508
▫ ERI from top 1% of licenses	\$3,041	\$3,591	\$17,053	\$9,784	\$9,508
▫ ERI from top 5% of licenses	\$3,041	\$3,591	\$17,053	\$9,784	\$9,508
▫ ERI from top 20% of licenses	\$3,041	\$3,591	\$17,053	\$9,784	\$18,573

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

² Represents a single license.

Forest Service (FS)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
• Total income , all licenses active in the FY	N/A	N/A	N/A	\$46,080	\$25,015
• Invention licenses	N/A	N/A	N/A	\$46,080	\$25,015
- Patent licenses	N/A	N/A	N/A	\$46,080	\$25,015

Disposition of License Income ¹

Agricultural Research Service (ARS)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
• Income distributed²					
▪ Invention licenses, total distributed	\$2,297,065	\$2,675,740	\$2,561,281	\$3,158,217	\$3,013,552
▫ To Inventors	389,927	831,375	998,042	1,015,450	756,458
▫ To Others	1,280,002	1,226,104	1,032,573	1,344,186	1,562,427
- Patent licenses, total distributed	\$2,274,043	\$2,661,184	\$2,534,208	\$3,114,853	\$2,958,996
▫ To inventors	\$380,916	\$821,677	\$982,756	\$990,344	\$728,892
▫ Salaries of some technology transfer staff	\$1,265,991	\$1,221,246	\$1,020,786	\$1,325,928	\$1,535,437
▫ Patent filing preparation, fees, and patent annuity payments	\$627,136	\$618,261	\$530,666	\$798,581	\$694,667
▫ Other technology transfer expenses	\$0	\$0	\$0	\$0	\$0
- Material transfer (invention) licenses, total distributed	\$23,022	\$14,556	\$27,073	\$43,364	\$54,556
▫ To inventors	\$9,011	\$9,698	\$15,286	\$25,106	\$27,566
▫ Salaries of some technology transfer staff	\$14,011	\$4,858	\$11,787	\$18,258	\$26,990
▫ Patent filing preparation, fees, and patent annuity payments	\$0	\$0	\$0	\$0	\$0
▫ Other technology transfer expenses	\$0	\$0	\$0	\$0	\$0

¹ Includes data from FS through FY 2006.

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

Forest Service (FS)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
• Income distributed					
▪ Invention licenses, total distributed	N/A	N/A	N/A	\$15,890	\$8,500
▫ To Inventors	N/A	N/A	N/A	\$15,890	\$8,500
▫ To Others	N/A	N/A	N/A	\$0	\$0
- Patent licenses, total distributed	N/A	N/A	N/A	\$15,890	\$8,500
▫ To inventors	N/A	N/A	N/A	\$15,890	\$8,500
▫ To Others	N/A	N/A	N/A	\$0	\$0

DOWNSTREAM OUTCOMES FROM TECHNOLOGY TRANSFER ACTIVITIES



NUTRITIOUS SUSHI WRAPS

A rainbow of new flavorful, healthy sushi-type wraps will be appearing soon on a menu near you. Food technologists at ARS's Processed Foods Research Unit in Albany, CA, developed (and filed for patent protection) fruit and vegetable wraps, or sheets that can be used in the culinary arts and food preparation. Along with Cooperative Research and Development Agreement (CRADA) partner Origami Foods, LLC of Pleasanton, CA, they have developed a variety of wraps to envelop any number of sushi fillings, including bright-orange carrot-based wraps, deep-red tomato and basil wraps, pineapple-apricot-ginger wraps, broccoli wraps, and even blueberry and strawberry wraps for desserts.

All the wraps are at least 75 percent vegetable or fruit, plus other wholesome natural ingredients. Besides being fun to eat, the sushi-style delicacies are ideal for weight-conscious Americans trying to control portion size.

The researchers perfected the formulations—with culinary input from two well-known sushi chefs and other food industry experts—and techniques for making the wraps at ARS's pilot plant at the Western Regional Research Center in California. Origami recently opened a factory with six full-time employees in Stockton, California, a rural area in need of new employment opportunities, to mass-produce the product. The San Joaquin County Revolving Loan Fund (local government



unit), approved financing for the factory and provided assistance in selecting a site and providing permits.

The carrot wraps are available on Sunny California Roll sushi products around the country in Trader Joes stores, and the apple wraps are available on spiral cut hams as glaze sheets.

BREAKTHROUGH BLUEBERRY DISCOVERY

ARS researchers have made pivotal discoveries that are changing the way consumers, food manufacturers, and researchers are looking at blueberries. Before this small, seasonal fruit was thought of mostly as good for garnish, a pie or muffin ingredient, or a flavoring — and perhaps viewed as a nice addition to summer’s fruit selection. Now that ARS and University of Mississippi researchers in Oxford, MS discovered that pterostilbene (a compound found in blueberries) lowers bad cholesterol, while increasing good cholesterol—this berry is a nutritional powerhouse. This together with research by ARS scientists in Boston, MA that indicates polyphenolic compounds in blueberries can prevent age-related deficits in memory and motor function, and may help in preventing neurodegenerative diseases such as Alzheimers’s have caused blueberry sales to soar.



Since the results of these studies, and widespread media coverage, blueberry sales in Britain have risen by up to 185% since 2005. In the United States, increase in blueberry demand has been unprecedented, along with a boost in blueberry sales. Many new commercially available blueberry products cite ARS’s nutritional findings on pterostilbene. Industry is developing methods to standardize pterostilbene content in functional foods and dietary supplements. The researchers have applied for patent protection on the discovery, and are negotiating an option agreement to license pterostilbene for commercialization.



Chemist Agnes Rimando analyzes pterostilbene content in blueberries

Three patent applications have been filed for new discoveries related to pterostilbene, including new pharmacological properties such as improvement of cognitive and motor functions in aging, and colon cancer preventive activity. ARS has executed at least 20 material transfer agreements for providing pterostilbene to scientists in the United States and Europe. This technology fostered scientific endeavors and lead to the discovery of phenolic compounds for controlling or treating major diseases. This research has revived an interest in blueberries, which has helped blueberry farmers and the blueberry industry.

NUTRITION ON THE GO

Researchers at ARS's Western Regional Research Center in California developed a way to make 100% fruit bars in snack-sized portions. These new junior-sized bars weigh in at just under an ounce (25 grams), and provide the equivalent of about one serving of fresh fruit. They are the newest product line from Gorge Delights, Inc., of North Bonneville, WA. The company has exclusive licensing rights to use the ARS-patented technology to create bars from purees and concentrates.



JustFruit™ bars are all-natural, and come in six flavors: apple, apple-cherry, apple-raspberry, pear, pear-cranberry and pear-strawberry. The slim, go-anywhere packaging keeps bars soft and fresh, and allows them to fit easily into a child's lunchbox. The bars are very portable and convenient for nutrition on the go; they can be taken along for a hike, bike ride, camping, or a trip to the gym. With a two-year shelf life, the bars are handy for storing for emergency use in the car or at home. Flavorful, chewy bars made from apples, pears and other fresh fruit now come in a size perfect for kids—or for adults who want a healthy, small-sized snack.

The company's standard size fruit bars, each 1.4 ounces (40 grams), are available in the above flavors, plus apple-blueberry and pear-blueberry. Both bars are sold at many retail stores out West, like Walgreens, Whole Foods Market, Rosauers, New Seasons Markets, Haggen Food & Pharmacy, Top Foods and host of other retailers—the bars available from many on-line stores as well and from Gorge Delights at: www.GorgeDelights.com. All of the bars are gluten-free and kosher-certified, and do not contain fillers, preservatives or other artificial ingredients.

TRIMMING AMERICA'S GIRTH

ARS scientists in Illinois developed and licensed several patented-technologies that could help in America's weight battle. Calorie-Trim (C-Trim) and Nutrim are made from agricultural products like oats and barley, and are licensed to VDF FutureCeuticals of Momence, IL. FutureCeuticals offers "Trim" food ingredients that can be used in smoothies, meal-replacement beverages, desserts, soups, spreads, salad dressings, bars, and a host of other nutritional products. The "Trim" products are lower in calories; they also help reduce cholesterol and lower blood glucose linked to diabetes. Trim ingredients are light, tasteless, and serve as a fat replacer. They are perfect for baked goods and a host of other products—like ice cream, chocolate, peanut butter. This ingredient is listed on the label of hundreds of commercial products as hydrolyzed oat bran.

Z-trim is zero-calorie fat replacer made from an insoluble gel made from a variety of low-cost agricultural byproducts such as hulls of oats, soybeans, peas and rice, or bran from corn or wheat. This ARS-technology is licensed to Z-Trim Holdings Inc. of Mundelein, IL. Major food manufacturers and private companies are purchasing Z-trim for use as a food ingredient in a variety of product lines. New York Times bestseller, “You on a Diet: The Owner’s Manual to Waist Management,” written by Drs. Roizen and Oz from the Discovery Health Channel, mention Z-trim as a “hopeful” new ingredient “that may eventually change the way we eat.”



BOOSTING AMERICAN’S VITAMIN D CONSUMPTION

Vitamin D is essential in aiding the body with promoting bone growth and strength, helping maintain a healthy immune system and is believed to play a role in preventing many cancers and dementia. ARS food technologists in California collaborated with the country’s largest fresh mushroom provider, Monterey Mushrooms—headquartered in Watsonville, CA— under a CRADA to develop a process for forming extra vitamin D to mushrooms.

Many Americans are believed to be deficient in vitamin D. Although, sun exposure can help the body produce vitamin D, too much exposure poses the risk of developing certain skin cancers. In addition, many of the foods we eat do not contain sufficient amounts of vitamin D. The ARS process uses UVB rays—also found in sunshine—to boost mushrooms’ vitamin D content. One serving of Monterey Mushrooms’s Sun Bella-brand mushroom line, which launched this Fall, contains the daily recommended allowance for vitamin D. Monterey sells its mushrooms worldwide for consumer and processing use. Mushrooms can easily be added to sauces, marinades, soups, salads, and other foods to enhance their vitamin D content.





PROTECTING U.S. TROOPS AGAINST INSECT-BORNE ILLNESS

ARS researchers in Gainesville, FL, teamed with the U.S. Marine Corps (USMC) to help solve a key problem—improving uniforms’ mosquito protection capabilities. Diseases transmitted by mosquitoes, like malaria, West Nile, and Yellow fever have significantly impacted the outcome of military operations today and in the past.

ARS researchers used historical methods to evaluate repellent on the U.S. Army’s Battle Dress Uniforms, but these methods were not the best indicator of how protective a uniform was, nor was the test precise enough to qualify or disqualify uniforms factory-treated with mosquito repellent. Treating uniforms is a multi-billion dollar industry, and the outcome saves the military billions of dollars in medical expenses for disease treatment.

ARS researchers devised a rigorous protocol to assess the ability of repellent-treated uniforms to protect from mosquito bites—a novel and logical indicator of disease risk. The process determines the number of bites received by a volunteer wearing a treated uniform and corrects for the untreated uniform to provide a more realistic and valid indicator of repellent efficacy. The USMC adopted ARS’s procedure as the “standard” for qualifying companies that factory-treat uniforms with repellent.



ARS chemist Uli Bernier tests a piece of military uniform treated with repellent



In 2007, qualified contractors treated the USMC’s entire stock of 384,000 Marine Corps Combat Utility Uniforms with uniforms that provide more than 90% bite protection for more than 50 wash cycles—exceeding uniforms’ maximum

life. Now, the Natick Soldier Center, which oversees development of U.S. Army uniforms is relying on the ARS technology to evaluate treatment and guide development of their more than four million uniforms—including new Fire Resistant Army Combat Uniforms, manufactured from flame-resistant fabrics.

Medical treatment of personnel infected with diseases can cost over 100 times more than properly treating uniforms with repellent. ARS’s technological contributions have had a significant impact in protecting American service personnel from debilitating disease and death, and results in a great cost savings to the Federal government and U.S. taxpayers.

Uli Bernier won one of the agency’s 2008 Technology Transfer Awards for this accomplishment.

IMPROVING DAIRY PRODUCTS USING HI-TECH TOOLS



Consumers want high quality beef and dairy products. However, these qualities must be part of a cattle’s existing genetic makeup. They must be born with it; it doesn’t happen during processing, or at the supermarket, or in the kitchen.

“Progeny testing,” the method now used to determine a bull’s genetic merit, is time-consuming and costly. Because a bull cannot be evaluated directly for milk production traits or meat quality

traits, like tenderness or flavor, a bull owner will generate many daughters from a bull, wait for them to mature and have a calf, and produce milk—and ultimately wait to see how those animals compare to offspring from competing bulls.

ARS researchers in Maryland and Nebraska are trying to speed this process, and make it more efficient by using more precise techniques to look at a cattle’s genetic makeup—DNA markers.

Using technology originally used in the human genome project—the BeadChip—ARS scientists worked with university professors and Illumina (the San Diego firm that manufactures BeadChip) to design a chip for genomics-based studies on dairy cattle. The researchers developed a new genomic method—called “genome-enhanced improvement”—to identify bulls that produce progeny with optimum milk production and other traits.

The BeadChip can be used to specifically characterize single DNA markers over 58,000 locations, distributed relatively evenly across the bovine genome. The researchers are using this tool to examine DNA from 15,000 cows and bulls representing several commercial dairy and beef breeds and ARS populations. This technology has revolutionized breeding efforts. The information can be used to correlate DNA data to traits of interest, such as milk, fat, and protein production. Eventually, information derived from the markers will help dairy and beef producers streamline their identification and breeding efforts. Cutting test costs, while increasing the genetic improvement rate in dairy cattle, will help make the U.S. breeding industry more globally competitive.

ARS researchers worked with Illumina to commercialize a new hi-tech tool, the BovineSNP50. Since its inception in early 2008, sales of the BovineSNP50 total more than 200,000 samples (approximately \$25 million) for 23 scientific locations in 11 countries.



The research was so intriguing and valuable to scientists worldwide that the researchers formed the iBMC consortium—stands for **I**llumina, **B**eltsville (ARS), **M**issouri (university) and **C**lay Center (ARS)—to continue sharing and exploring genetic data generated using the BeadChip. In addition, other consortiums were formed to evaluate using the technology to identify genetically important traits in sheep and pigs.

The iBMC Consortium team won one the agency’s 2008 Outstanding Effort Technology Transfer Awards for this work.

HELPING U.S. RANCHERS

ARS researchers at the Poisonous Plant Research Lab in Utah are experts on natural chemicals in lupines, poison hemlock and other poisonous plants that cause birth defects in cattle, sheep, horses, goats and other livestock. Lupine, a perennial plant in the legume family, can cause heavy losses to cattle producers in the channel scablands of east-central Washington. The channel scablands is land that is only good for grazing cattle or sheep, and not suitable for crop farming.

It is estimated there are more than 20,000 cows in the scablands and neighboring regions of the western United States (over 800 square miles of rangelands)—many of which are covered with poisonous plants, like lupine. Lupine affects many U.S. ranches in the west and western Canada. When pregnant cattle graze on lupine plants, it can lead to calf death or “crooked calf syndrome” in offspring. Crooked calf syndrome increases required veterinary care by 60% due to the need for a C-section or assisted delivery.

In 1997, catastrophic losses occurred on the scablands, with 4000 calves from approximately 12,000 cows affected with crooked calf syndrome, many of which were destroyed. ARS researchers estimated the cost was approximately \$5 million in dead calf losses, and associated economic losses. In 2003 a rancher in southeastern Idaho lost over 40% of his calves, and in 2007 a rancher in Spokane, WA lost 25% from lupine-induced crooked calves.

The ARS lab gets 10-12 calls each spring with a 1-5% incidence of crooked calf syndrome on many ranches. The lab provides plant identification, chemical analysis information, and management suggestions to avoid further losses to extension agents, cattle producers and ranchers.



Calf with crooked leg syndrome



Cattle grazing on lupines

ARS researchers developed a Goat Cleft Palate Model to study the mechanism of lupine-induced “crooked calf syndrome” in cattle. Part of crooked calf syndrome includes a cleft palate in the baby calf, resulting from cows that eat lupine very early in pregnancy. ARS scientists are working with physicians in the biomedical field to develop new procedures and techniques for cleft

palate treatment in children using ARS’s model. This research demonstrated that by repairing the goat fetal cleft at 85 days gestation (150 days is term)—while still in the uterus—the fetus was able to heal. When born, the palate was essentially normal. This model allowed the researchers to find the mechanism that caused the cleft palate and skeletal malformations in cattle.

PREVENTING MAREK’S DISEASE

ARS researchers in Michigan have developed and licensed several hybridoma cell lines producing monoclonal antibodies to Marek’s disease virus (MDV). MDV is a member of the herpes virus, which causes Marek’s disease in poultry. The disease manifests as malignant tumors (cancer) on bird’s spleen, liver, lung, kidney, and other tissues. Disease symptoms include neurological disorders, such as partial paralysis in the bird’s legs or wings. Worldwide losses attributed to Marek’s are estimated at \$1 billion annually.

In the United States, most commercial chickens are vaccinated against Marek's disease virus type 1 (MDV1), while inside the egg. In Europe, chicks are vaccinated when they are one day old. Although these vaccination programs have for the most part been very successful—saving the industry billions of dollars—Marek's disease still persists. The challenge is developing new vaccines, since virus strains keep evolving. ARS cell lines producing antibodies to vaccine strains are critical diagnostic reagents for distinguishing between vaccines. They should help the animal vaccine industry develop new, more effective vaccines against existing viral strains and future viral strains. ARS executed three biological material licenses for its cell lines to businesses in the United States and abroad.



PORTABLE DEER LIFT

ARS scientists in Texas developed and patented a more humane portable device to restrain deer and other wildlife. The device is designed to help researchers conduct field studies to control ticks and other parasites feeding on deer. It effectively restrains wildlife with minimal trauma to the animal.

Various tick species transmit disease to humans, such as Lyme disease, Rocky Mountain Spotted Fever, anaplasmosis, ehrlichiosis, babesiosis, and other diseases. Ticks can also cause numerous severe and often fatal diseases in livestock, such as Texas Cattle Fever and Red Water Fever.



The ARS device includes an open front that allows an animal to enter, while the rear end includes a door that opens and closes—effectively containing the animal without injuring it. When the animal enters, it is immobilized by gently lifting it by its shoulders and trunk, so its legs are suspended off the ground. The device can be used to treat wildlife with repellents or pesticides to ward off hitchhiking pests, as well as to apply vaccines, antibiotics, etc. to improve animal health.

Students in Boerne High School’s Welding Technology Program, along with their instructor, built a mobile deer working facility that includes ARS’s portable lift chute device. The class entered their “prototype” design into several statewide high school welding competitions and won \$18,000 in scholarships and \$34,200 in tools for the Welding Technology Program.

ARS has purchased the device. ARS will be working with USDA's Animal and Plant Health Inspection Service Cattle Fever Tick Eradication Program to use the device to capture deer to help in its efforts to maintain eradication of cattle fever ticks, and the potentially fatal Texas Cattle Fever—also known as bovine babesiosis—from U.S. cattle herds.



NEW APRICOT VARIETIES

Approximately 12-15 major producers grow approximately 13,000 acres of apricots in the United States, primarily in California. California growers produce most of our nation's apricot supply—largely thanks to ARS's apricot breeding program.

ARS researchers in California developed many new and improved apricot varieties for the U.S. apricot industry—six of which combined account for 18% of all apricots sold in the United States. ARS apricot varieties ripen longer—providing U.S. growers more shelf-time in commercial markets.

Apricot breeding is a long, arduous process that takes many years from selection to commercial availability of a particular variety. Only today, are consumers able to see “the fruits of our labor” that began more than 15 years ago. Through an extensive selective breeding program, ARS researchers produced new varieties that have higher sugar content—meeting consumer demands for sweeter tasting apricots. Some of these sweeter apricots are processed into marmalades, jams and jellies for high-end gourmet markets—resulting in higher profits for producers.



Kettleman apricots

ARS publicly releases most of its varieties—like Kettleman and Nicole. However, some recent varieties, like Robada, have been patented and licensed to apricot growers nationwide. U.S. growers wanted patent protection on these varieties to help secure their space in a globally competitive market place. ARS's contribution to the apricot industry helps stimulate U.S. competitiveness against imported commercial apricot varieties.

Other ARS varieties broadening the spectrum for consumers' fresh-market-produce selections include Apache, Lorna, and Helena. Helena ripens just before Patterson—the

ARS geneticist Craig Ledbetter studies a flowering apricot branch



late-season variety that accounts for approximately 60% of California apricot production. Helena has proven itself as a high quality export apricot in Chile, providing U.S. consumers with a good quality apricot during the Christmas holiday season.

As American consumers seek more nutritional variety in their foods, this nutritionally packed fruit—with essential nutrients, like vitamins A and C—add to their offerings. In addition, ARS curates the nation's official collection of apricot trees from around the world.

Craig Ledbetter won one of the agency's 2008 Technology Transfer Awards for developing commercially successful apricot varieties.

PROTECTING PEANUTS AGAINST AFLATOXIN

The peanut industry and consumers alike will benefit from a newly-developed ARS biological pesticide that protects peanuts from fungi that produce aflatoxin—a group of highly toxic, carcinogenic metabolites produced by the fungi, *Aspergillus flavus* and *A. parasiticus*. The fungi can invade and grow in peanuts prior to and after harvest, contaminating the crop. Aflatoxin contamination is both a food safety issue and an economic burden for the peanut industry.

The U.S. Food and Drug Administration regulates aflatoxin contamination. All U.S. shelled peanut lots are monitored for aflatoxin. Lots containing greater than 15 parts per billion are removed from commercial distribution. Economic analysis indicated the average annual net cost to the farmer, buying point, and sheller segments of the industry in the U.S. southeastern region was almost \$26,000,000. Most of this cost (\$22.7 million) was borne by shellers.

ARS researchers in Georgia helped solve this important economic problem—since no product existed to prevent contamination. Although ARS was able to secure three patents on the technology, serious obstacles stood in the way of industry adoption of the technology.



A primary obstacle to transferring this research was finding a commercial partner to gain U.S. Environmental Protection Agency registration of the newly developed biopesticide.



A new company, Circle One Global (COG), Inc., licensed ARS's technology, and named it afla-guard®. ARS worked closely with COG in designing a manufacturing facility to produce high-quality afla-guard®. ARS researchers led the initiative to overcome the EPA registration hurdle. Working with industry, ARS researchers demonstrated that afla-guard® is environmentally-safe and okay for food-grade

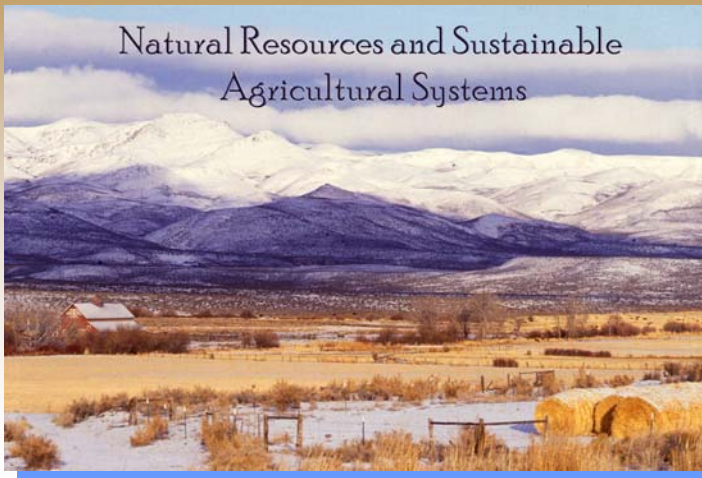
peanuts. Crops using afla-guard® had an average of 86% aflatoxin reduction, and up to a 98% reduction in shelled stock peanuts. Afla-guard® received EPA registration as a biopesticide.

In 2007, COG sold afla-guard for treatment of 35,000 acres of peanuts. One peanut shelling plant using afla-guard® had a net value increase of 15.3%, translating to an increase in farmers' stock peanut value of \$56.23 per ton.

ARS researchers also studied the product in corn. The results were so promising that EPA amended the original product label to allow using afla-guard® on corn beginning in 2009.

Since aflatoxin is a worldwide problem, ARS is working with scientists in other countries to evaluate afla-guard® in their unique settings—including in Brazil, South Africa, Mozambique, and Malawi.

Joe Dorner won a 2008 ARS Technology Transfer Award for his efforts.



RECREATING THE WEATHER

ARS researchers in Minnesota and Cooperative Research and Development Agreement partner Percival Scientific, Inc., of Perry, Iowa, developed WeatherEze™, a computer program that can simulate almost any set of environmental conditions around the globe. Climate conditions are recreated using plant growth chambers.

ARS studies plant growth in chambers for a variety of research purposes, including mimicking environmental conditions that may result from global climate change. By studying climate change conditions, ARS researchers can develop new crops and practices to adjust to changing world environmental conditions—allowing for better crop monitoring and resource (water, fertilizers, etc.) allocation.

WeatherEze™ is commercially available and runs Percival-controlled environment chambers and incubators from any computer equipped with Microsoft Windows. It connects the chambers to hourly reports from airport weather stations throughout the world via METAR weather data (visit: <http://weather.noaa.gov/weather/metar.shtml>).

ARS scientists developed computerized statistical models to use weather and latitude and longitude data to estimate weather variables such as sunlight amount and quality, and to recreate those conditions in chambers automatically.

WeatherEze™ allows researchers to recreate daily climates of various regions of the world.

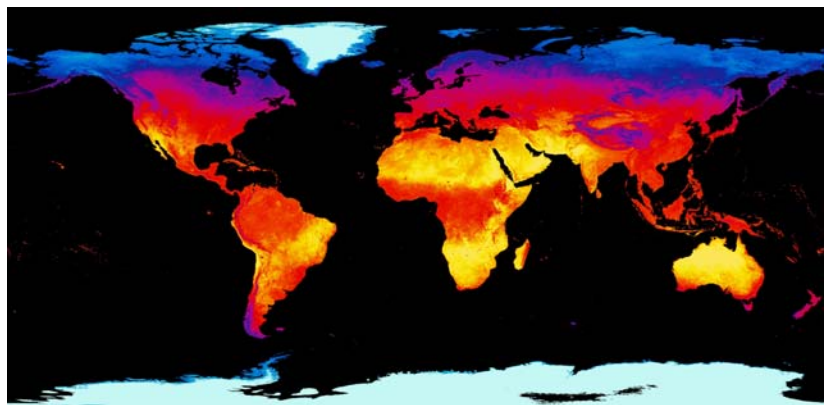


Photo credit: NASA Earth Observations
Land Surface Temperature

The software can also recreate past climate scenarios for global warming studies, using weather data from the past 30 years. WeatherEze™ can also control carbon dioxide levels (provided this feature is available in the growth chamber).

WORKING WITH FARMERS TO IMPROVE BIOENERGY EFFICIENCY



ARS geneticist Ken Vogel studies switchgrass plants

A team of ARS and University of Nebraska scientists worked with 10 farmers in Nebraska, South Dakota, and North Dakota to grow and manage switchgrass fields for five years as a biomass energy crop. Switchgrass is a native prairie grass long used for conservation plantings and cattle feed in the United States.

The scientists used data from these field trials to demonstrate that switchgrass used for biomass ethanol would produce over 540% more energy than the total used in its production and conversion. On average, switchgrass production costs were \$60 per ton.

The five farmers with the lowest costs had production costs of less than \$50 per ton, which should be achievable by other farmers as they gain production experience. At a cost of \$50 per ton—assuming a conversion efficiency of 80 to 90 gallons per ton—farm-gate production cost of cellulosic ethanol from switchgrass would be about \$0.55 to \$0.62 per gallon.

This study provides the first real-world economic and net energy analyses of switchgrass and similar perennial cellulosic energy crops. It provides essential feasibility information for emerging U.S. bioenergy industries—indicating that switchgrass is promising as a high-yielding bioenergy crop.

KEEPING OUR WATERS CLEAN

ARS scientists in Tucson, AZ and U.S. Environmental Protection Agency (EPA) researchers developed a new computer-modeling tool that helps keep our nation's watersheds cleaner. More than 80% of our fresh water comes from precipitation that falls on watersheds and seeps into groundwater or flows into streams and reservoirs. A watershed is an area of land that collects water from various sources—like rain, snow, or runoff—that is discharged into nearby waterways such as lakes, streams, and rivers.

The Automated Geospatial Watershed Assessment (AGWA) tool helps assess land-use and climate-change impacts on water yield and quality. AGWA can use data from many sources, and enables the user to easily visualize and compare results using a geographic information system (GIS) software package. It can be used to predict land management practices on water resources. For example, AGWA can estimate trends, and the magnitude of sediment effects and chemical yields.



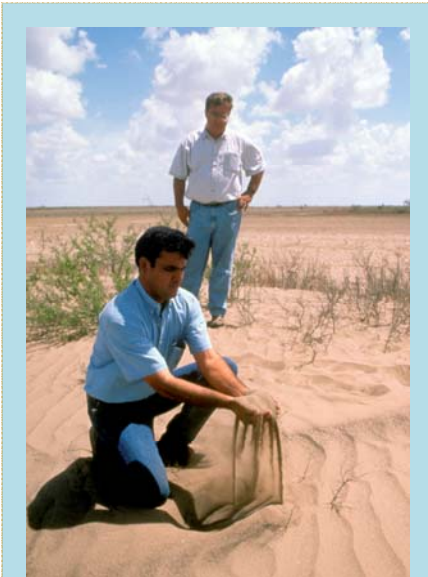
Experimental Watershed in Arizona

Prior to AGWA, no such tool existed. Now, decision makers, land managers, farmers, and environmentalists have a single, comprehensive tool that can provide a long-range model to evaluate large, complex watersheds with varying soils, land uses, and management conditions—and related environmental and economic impact.

EPA and USDA's Natural Resources Conservation Service use AGWA to develop sound policies for managing water. Now, more than 600 registered users worldwide are using this tool. Free downloads are available at: www.tucson.ars.ag.gov/agwa.

The researchers won a 2008 ARS Technology Transfer Award for this development.

WIND EROSION PREDICTION SYSTEM (WEPS)



A farmer assesses wind erosion on his land

Wind erosion is a major problem on about 75 million acres of U.S. land. About 5 million acres are moderately to severely damaged each year. Wind erosion physically removes the most fertile portion of the soil. Some soil from damaged land becomes part of the atmospheric dust load. Dust obscures visibility and pollutes the air, causes automobile accidents, fouls machinery, and imperils animal, plant, and human health.

Wind erosion is also a serious problem in many parts of the world, and is worse in arid and semiarid regions—like North Africa and the Near East; parts of southern central, and eastern Asia; the Siberian Plains; Australia; northwest China; and southern South America.

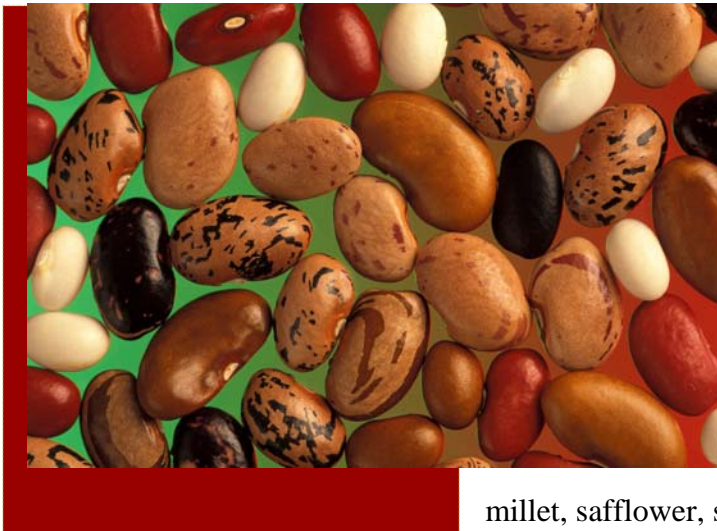
ARS scientists in Kansas, as part of a partnership with Natural Resources Conservation Service

(NRCS) scientists, developed the Wind Erosion Prediction System (WEPS). WEPS is a computer model that is the latest cutting-edge tool for forecasting wind erosion damage, which incorporates improved technology for computing soil loss by wind from agricultural fields. WEPS is an easy-to-use process-based prediction tool for planning soil conservation systems, conducting environmental assessments, and evaluating offsite impacts caused by wind erosion. It simulates weather, field soil and crop conditions and wind erosion on a daily basis—allowing the model to better simulate specific daily site conditions.



WEPS is an important scientific tool that will help landowners in areas with severe wind erosion, like Kansas, Nebraska, Colorado, Oklahoma and Texas. NRCS conservationists will use this tool to help make conservation decisions and to formulate specific wind erosion control practices—like establishing a soil-stabilizing crop cover, setting up windbreaks and barriers, or improving soil stability to reduce erosion.

CROP SEQUENCE CALCULATOR



In February 2008, ARS scientists in North Dakota developed and released a new version of the Crop Sequence Calculator (CSC). CSC is a user-friendly computer software program that assists agricultural producers with developing diverse cropping systems in semiarid regions. The CSC can calculate the expected yield of sixteen crops—barley, buckwheat, canola, chickpea, corn, crambe, dry bean, dry pea, flax, grain sorghum, lentil, proso

millet, safflower, soybean, sunflower, and spring wheat—grown in any two-year combination.

Summary statements on crop production, plant diseases, insects, weeds, crop water use, and soil quality are provided in the program to assist agriculturists with crop sequencing decisions to reduce production risks.

Information provided in CSC can save producers money by optimizing net returns for a given crop sequence. For example, based on information provided in CSC, a producer

who grows dry bean after barley can expect an average net loss of \$3 per acre. However, if the same producer grew dry bean after wheat, the result would be a net gain of \$64 per acre.

CSC is also an educational resource and teaching tool at many universities—including Colorado State University, Iowa State University, Montana State University, South Dakota State University, and North Dakota State University. CSC is designed for crop advisors, agricultural producers, consultants, commodity representatives, bankers, agricultural researchers, and others. More than 12,000 copies of CSC have been distributed throughout the world. The new CD is available online at:
<http://www.ars.usda.gov/Main/docs.htm?docid=13698>

