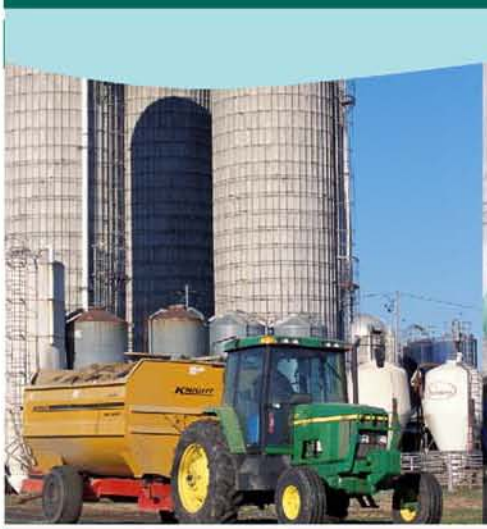
United States Department of Agriculture
Annual Reporting on Technology Transfer
FY 2010



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EXECUTIVE SUMMARY

The principal goal of Federal research and development (R&D) is to solve problems and achieve anticipated public benefit. Agencies themselves cannot do this alone; rather, it is the private sector that serves as the essential delivery mechanism and intermediary between public research and realization of public benefit. Additionally, private sector involvement also adds the benefits of creating new or expanded businesses, jobs, and economic prosperity.

USDA broadly defines technology transfer as the adoption of research outcomes (i.e., solutions) for public benefit. These science-based innovations from USDA intramural research --- through these public / private partnerships --- create new or improved technologies, processes, products and services that benefit the nation by increasing productivity, increasing efficiency (keeping costs low) and enhancing global competitiveness for the U.S. agriculture sector. Thus, technology transfer functions are critical to accelerating utility of public R & D investments, creating economic activity, and in job creation and sustainable economic development.

Principal among the formal instruments of technology transfer are Cooperative Research and Development Agreements (CRADAs), patents, and invention licenses for commercialization by the private sector, as well as material transfer agreements and germplasm releases to industry. To assist USDA in transferring technologies to the private sector, the Agricultural Research Service (ARS) created the Agricultural Technology Innovation Partnership (ATIP) program consisting of 10 economic development organizations across the U.S. serving as "intermediaries" to further enhance likelihood that research outcomes would be adopted by the private sector for commercialization. ATIP members coordinate regional co-sponsored events with ARS, showcasing available technologies for licensing, and USDA intramural research capabilities available to businesses to assist in solving high priority, mission-related issues connected to the agricultural industries. Additionally, members provide the current or prospective private sector partners of ARS with access to business mentors, entrepreneur schools, seed and venture funds, and the Manufacturing Extension Partnership programs.

The Agricultural Research Service (ARS) has been delegated authority by the Secretary of Agriculture to administer the patent program for ARS, the review of CRADAs and the technology licensing program for all intramural research conducted by USDA. Thus, this report covers technology transfer activities and metrics for the Agricultural Research Service (ARS), the Animal and Plant Health Inspection Service's Wildlife Services (APHIS-WS), and the Forest Service (FS). The report includes tabular metrics of inventions, licenses, and Cooperative Research and Development Agreements for ARS, APHIS-WS, and FS, as well as a section on notable "downstream outcomes." USDA also works collaborative with the Department of the Interior, Bureau of Reclamation on technology transfer issues common to both departments, with an emphasis on water availability and water quality in the western states. These interactions are also described in this report.

The continuing severe global economic recession was apparent in some key metrics for FY 2010, such as licensing activity where only 22 new licenses were executed (compared to typical 25-27). In several cases, private sector firms withdrew applications, citing economic hardship. However, ARS licensing program has a strong emphasis on partnerships with universities (consolidation of rights in jointly-owned inventions) and small businesses. Of 323 active licenses, over 130 are producing 1 or more products for sale. Approx. 35% of patents in ARS portfolio are jointly owned with university and private sector cooperators, and approx. 30 of these are among those licenses with product for sale. Despite severe economic recession, revenues exceeded last year's; licenses generated more than $3.6M in revenues; over $1.3 M was awarded to inventors.

In contrast to new licensing metrics, new Cooperative Research and Development Agreements (CRADA) executed in the FY revealed a dramatic increase. ARS has prioritized CRADA development for ARS scientists to offset diminishing discretionary funds while enhancing relevance to the private sector for near-term commercialization of outcomes: 83 new CRADAs were executed (previous record was 69), and 92 others were expanded. The current 262 active CRADAs for ARS scientists are valued at nearly $180M over life of the CRADAs (up to 5 years) with $18M in funds to ARS researchers (approx. $5.2M during FY). 62% of the active CRADAs are with U.S. small businesses. Several companies indicated that, with tough economic conditions, they prioritized investments in research partnerships with ARS rather than licensing activity, citing the high quality of research conducted, and the high reputation for delivering practical results.

The "Downstream Outcomes" reflect the breadth of mechanisms used by USDA to effect technology transfer, as well as the breadth of scope in addressing issues for the agriculture sector. Technology transfer mechanisms for the 30 downstream outcomes from ARS science highlighted in this report include use of Material Transfer Agreements (1), patent available for licensing (1), CRADAs (4), invention licensing (9), and public release of information (14) or plant varieties (1). Breadth of issues that these technologies resolve span chemical pesticide reduction and biocontrol agents; reducing animal waste runoff; pathogen detection in plants, animals, water, and foods; toxin detection in foods and soils; improved repellents of insect vectors of human and animal pathogens; insect pest detection in individual cereal grains; enhanced genetic trait analysis for breeding in cattle; biofuel crops and production / conversion technologies; and improved plant materials for rangeland and pasture environments that have been used in several million acres of U.S. lands (fire reclamation) and military installations. Toward the goal for developing improved plant materials on a global basis, through its National Genetic Resources Program, and the Germplasm Resources Information Network, ARS distributed over 172,000 accessions throughout the world in 2010 on six continents (map presented).

Five "downstream outcomes" highlighted from APHIS Wildlife Services reflect vaccines for wildlife, deterrents for birds that damage utility poles, technology to prevent deer / vehicle collisions, and technologies to reduce bird populations that are air strike hazards near airport runways.

Ten technologies are highlighted from intramural research conducted by the Forest Service. These span "green" adhesives for wood composits, biocides for wood-damaging molds, weed control technologies, efficient reforestation technologies, ethanol production from woody biomass, and technologies to reduce forest fire fuels.

In 2010, the technologies highlighted in this report -- arising from these USDA intramural research agencies --- garnered nine agency Technology Transfer Awards, and 10 Federal Laboratory Consortium for Technology Transfer Awards (FLC). The latter awards are bestowed in competition with technologies from all federal R&D agencies; these awards reflect the high quality of USDA research outcomes and their successful adoption by end users.

U.S. Department of Agriculture (USDA)

Annual Reporting on Agency Technology Transfer[1]

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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.

[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).

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 20 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. ARS conducts a series of review processes designed to ensure the relevance and quality of its research work and to maintain the highest possible standards for its scientists. This process involves customer input to help keep the research focused on the needs of the American food and agricultural system. Each of the approximately 1,000 research projects undergoes a thorough independent external prospective peer review conducted by the Office of Scientific Quality Review (OSQR). All ARS employees, including the scientific workforce, are subject to annual performance reviews. Senior scientists undergo a rigorous peer review (Research Position Evaluation System-RPES) on a 3- to 5-year cycle. These processes ensure the continuing high quality output of the ARS research addressing the needs of American agriculture.

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

The ARS Office of Technology Transfer also provides full Technology Transfer 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 Conducting 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.

The technology transfer operation is centralized in policy and approval procedures, but maintains field offices to provide one-on-one customer service to intramural researchers. To facilitate technology transfer, the office 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* (8 in-house registered patent agents) provides

strategic guidance to scientists in protecting IP, coordinates invention reports and Invention Disclosure Review Committees, prepares and prosecutes patent applications, and oversees any patent applications prepared by contract law firms for foreign patent rights. The *Licensing Section* (4 specialists) negotiates licenses for IP developed by USDA scientists and monitors license performance. The *Marketing Section* (staff of 3) 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, 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. By policy of ARS, IP related to research tools is not protected so as to encourage scientific research.

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 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. ARS is continuing to work on defining better metrics for technology transfer in USDA. 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. Additionally, ARS uses its partnership intermediary network (see below) to gather economic impacts of technology adoption by private sector partners, including jobs created, regional impact on the economy, and ability to match technical expertise of intramural researchers with firms who can capitalize on this national network of labs, regardless of geographic proximity to the businesses.

ARS 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 mechanism to review new plant varieties to determine the merits of protecting and licensing intellectual property, versus making a public release. This module allows ARS to track research outcomes and document private-sector adoption. Collectively, this improved infrastructure enables ARS 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.

ARS uses a different ARIS module for the Technology Transfer Coordinators (TTC) 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 program and regional managers to monitor accomplishments and receive early notice of anticipated future technology transfer activities.

Development of the Agricultural Technology Innovation Partnership program to Enhance Technology Transfer

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 recent global economic downturn has further 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 further enhance likelihood that research outcomes would be adopted by the private sector for commercialization. The program was born from the recognition that federal intramural R&D agencies were limited by mission and resources in the services they can provide to U.S. businesses.

By statute, licensing any federal innovation requires that the applicant (business) provide a complete and sufficient business plan that describes their capabilities in marketing, manufacturing, access to fiscal resources, and their technical capabilities to develop products and services from the technology. Federal intramural R&D agencies can only offer "technical capabilities" through formal CRADAs with the licensee, but have neither the

resources nor the authority to assist with the other requirements of licensees (assets) needed by these businesses to be successful. Consequently, ATIP was established to strategically form geographic partnerships with well-established economic development entities that excel in providing the complementary assets that ARS cannot.

The ATIP Program is comprised of 8 economic development "Partners", each serving as a portal anchored to an ARS Area, and a 9th Partner representing a national organization, the National Association of Seed and Venture Funds. ATIP "Associates" work in conjunction with a proximal Partner. Currently, there is one ATIP Associate. Partners and Associates become members of ATIP through a Partnership Intermediary Agreement (PIA) executed with the Office of Technology Transfer. Members of ATIP include the Maryland Technology Development Corporation (TEDCO) in 2007, Mississippi Technology Alliance (MTA) in 2008, Wisconsin Security Research Consortium (WSRC) in 2009, National Association of Seed and Venture Funds (NASVF) in 2009, Georgia Research Alliance (GRA) in 2010, Ben Franklin Technology Development Authority (BFTDA) in 2010, Kansas Bioscience Authority (KBA) in 2010, Center for Innovation at Arlington, TX (CI@A) in 2010, California Association for Local Economic Development (CALED) in 2010, and the Center for Innovative Food Technologies, Toledo, OH (CIFT; an ATIP Associate with WSRC) in 2010. Eight of these members reflect recent additions to the network in FY 2010.

ATIP members coordinate regional co-sponsored events with ARS, showcasing available technologies for licensing, and ARS research capabilities available to businesses to assist in solving high priority, mission-related issues connected to the agricultural industries. Additionally, members provide the current or prospective private sector partners of ARS with access to business mentors, entrepreneur schools, seed and venture funds, and the Manufacturing Extension Partnership programs.

In June 2010, the first meeting of the entire complement of ATIP intermediaries was held to coordinate and plan activities in the ATIP network in support of technology transfer for the ARS and sustainable innovation-based economic development. Extensive discussions occurred on the complementary assets that ATIP members could provide to ARS to facilitate technology transfer.

Also in June 2010, the ARS ATIP network met jointly with Members of the Department of Defense's Office of Technology Transition Partnership Intermediary Network (OTTPIN) to identify research and technology partnerships with the private sector in areas of common interest to DoD and USDA-ARS. Four topic areas were selected for further discussion on how to more fully collaborate.

In FY 2010 the ATIP accomplished:

- **California Association for Local Economic Development.** Created a Steering Committee composed of city and county economic development personal. Planning a water technologies showcase in May 2011 as an add-on to California State University at Fresno's Symposium "Sustainable Water Technology: International Solutions to Regional Issues." Working with the California Central Valley on highlighting ARS research and technology on the development and use of dryland oil seed crops for jet aircraft biofuels. Facilitated the negotiation and signing of 1 CRADA.

- **Center for Innovation**. Coordinated a showcase to highlight technologies and research capabilities of the Southern Plains Agricultural Research Center (SPARC). Several target technologies were identified and technology briefs were created for these technologies. Worked with their strategic partners to obtain market research for these technologies. Several potential licensees/CRADA partners have been identified. Started the design and building of an online innovation management system (TechComm Innovation Management System, TIMS). Planned and coordinated a working session between the DoD

Partnership Intermediary Agreement partners to enhanced understanding of the focus areas for each of the PIAs and provided the opportunity for the PIA network to learn more about TechComm and their work with ARS.

- **Center for Innovative Food Technology.** Organized a showcase to highlight ARS research and technologies in the areas of biobased products, biofuels, sustainable agricultural practices, food safety/nutrition, and functional food development. Coordinated a visit and tour of vacant properties within Toledo for potential soil remediation research with ARS and EPA. This visit has resulted in more extensive discussions with EPA on collaborative research on national urban agriculture water issues and soil remediation. Began discussions with Ohio Farm Bureau to assist in the distribution of information on ARS technologies to farmers in the state. Assisted in facilitating ARS precipitation at the Ohio Polymer Summit. Coordinated a webinar focused on biobased products through Ohio BioProducts Innovation Center.

- **Georgia Research Alliance.** Worked with the External Advisory Committee of its VentureLab Research Commercialization Program to review a list of ARS technologies and identify those technologies that appear to have greater commercial potential. Coordinated discussions with ARS and VentureLab professional on how to best move these technologies forward to licensing/commercialization. Began discussions related to a technology showcase related to zoonotic diseases, with an emphasis on vaccines, diagnostics and containment.

- **Kansas Bioscience Authority**. Developed an information brochure on ATIP and KBA. Discussed ARS technologies with stakeholders, Kansas entrepreneurs and business leaders to match technologies with companies. Planning a biofuels showcase in cooperation with Wisconsin Security Research Consortium to highlight ARS research and technologies. The showcase is scheduled for Spring 2011.

- **Mississippi Technology Alliance**. Coordinated a showcase that highlighted ARS geospatial research capacity and technologies. As a result of the showcase, scientists in different National Programs, as well as in different area locations, formed new collaborative research teams. These new interdisciplinary teams should increase the research capacity, impact and funding. Met with industry to highlight ARS technology for the production of fruit products. Coordinated discussions with a commercial partner to utilize the National Biological Control Laboratory (NBCL) for the creation of new biopesticides. These discussions resulted in extensive dialogs with EPA on creating a more effective technology transfer plan for the development of biopesticides from ARS facilities.

- **Maryland Technology Development Corporation.** Provided $150K to 2 ARS commercial partners for their use in supporting their CRADAs. Since 2005, TEDCO has provided ARS partners $675K to support their CRADAs. Provided business mentoring services to 4 CRADA partners. Organized the first Chesapeake Bay Foundation Showcase which highlighted technologies developed or in development that will help clean the Bay. One of the speakers was a company that built a business around an ARS technology license. Co-briefing with ARS-OTT and the White House Domestic Policy Council. Received $98K from the U.S. Small Business Administration to conduct agricultural forums around the state of Maryland. The mission is to identify the specific agricultural issues in each of the five rural regions of Maryland and to host the forums. This novel approach entails (1) a listening session of industry, farmers, economic development, regulatory and extension personnel to develop a list of agricultural related issues to address for their region; (2) a focused group then meets to discuss how USDA could address the issues; (3) ATIP and USDA meet to create a morning and afternoon topic for a

1 day Forum; and (4) convened the Forum with a roundtable discussion with ARS and companies, farmers, economic development, regulatory and extension personnel to address the regional agricultural issues. Relevant USDA technologies available for licensing are highlighted. Facilitated the negotiation and signing of 3 CRADAs and 2 licenses.

- **National Association of Seed and Venture Funds.** Conducted and released an economic impact study of licensed technology through ATIP intermediaries. CrispTek, LLC emerged from an entrepreneur school and was created on ARS technology license. CrispTek received funding from ATIP member and launched 1st sale 13 months later. After 1st year, product is now in 400 stores, 3 grocery chains, 3 major food manufacturer / distribution companies, also with robust internet sales. Economic impact study reveals that CrispTek has distributed economic benefits in 5 states (MD, TX, IA, IL, LA).

- **Pennsylvania Ben Franklin Technology Development Authority.** Participated in technology transfer training at the ARS location in University Park, PA. Held multiple discussions with researchers on their available technologies. ARS referred several companies to BFTDA for funding opportunities and several researchers requested assistance from BFTDA in finding partners. Facilitated the negotiation and signing of 1 CRADA.

- **Wisconsin Security Research Consortium**. In order to develop business plans for ARS technologies, interacted with ARS to provide selected technologies to the University of Wisconsin's business classes at the Oshkosh, White Water, Eu Claire, and Milwaukee campuses. In addition, identified a funding source for potential entrepreneurs. Organized 3 visits to the ARS **National Center for Agricultural Utilization Research (NCAUR)** with potential commercial partners. Coordinated visits to University of Wisconsin campuses at Oshkosh, Steven's Point and Marshfield by ARS. Coordinated the participation of ARS researchers in Wisconsin Tech Council Early Stage Symposium. Planning a biofuels showcase with Kansas Bioscience Authority. The showcase is being planned as an add-on program to the National Small Business Innovation Research Conference being held in Madison, WI on April 2011. Facilitated the negotiation and signing of 2 CRADAs and 1 licensing agreement.

Expanded and Enhance Technology Transfer

ARS continues to expand and improve its technology transfer activities in many ways. These include the following activities that reflect continued or new initiatives for FY 2010:

- ARS has prioritized CRADA development for ARS scientists to offset diminishing discretionary funds (Figure 1): 83 new CRADAs were executed (a record), 92 others were expanded; 262 active CRADAs for ARS scientists with value of nearly $180M over life of the CRADAs with $18M in funds to ARS researchers (approx. $5.2M during FY). 62% of the active CRADAs are with U.S. small businesses (Figure 2).

- The ARS licensing program has a strong emphasis on partnerships with universities and small businesses (Figure 3). 22 new licenses were executed. Of 323 active licenses, over 130 are producing 1 or more products for sale. Approx. 35% of patents in ARS portfolio are jointly owned with university and private sector cooperators, and approx. 30 of these are among those licenses with product for sale. Despite severe economic recession, revenues exceeded last year's; licenses generated more than $3.6M in revenues; over $1.3 M was awarded to inventors.

- Reviewed over 94 invention disclosures, 83 more were received and are awaiting review, 107 are awaiting patent application. A record 66 patent applications were filed with U.S. Patent and Trademark Office (USPTO). This year there has been a significant increase in the number of patents issues (TABLE 2).

- Negotiated the 1st of several umbrella agreements with biotech companies that permits ARS scientists to use proprietary biotech crops and traits in a wide variety of ARS research, including biotech risk assessment research.

- Developed a new Web-based module to provide updates and information to customers and stakeholders. This module provides enhanced searching abilities through a new patent portfolio of available technologies. The new list will highlight technologies from all ARS program areas.

- Coordinated ARS efforts to obtain conditional EPA registration for the transgenic 'HoneySweet' plum and drafted a 'shrinkwrap' license agreement that will be used for distribution of this variety. This is the first agreement of its kind for an ARS invention.

- For the first time pre-negotiated a CRADA Subject Invention license. Because of the nature of the research (develop new varieties of biofuel crops), cooperators usually would not enter into CRADAs without prior agreement to a license. This new approach allows these types of CRADA to go forward, as well as provide ARS useful information about business models for commercialization of ARS biofuel feedstocks.

- 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). A Request for Proposals (RFP) was drafted for five 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. Several potential tenants have established CRADAs with BARC researchers. The selection of tenants is expected in early FY2011.

- 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 Center for Innovative Food Technology (CIFT) to collaborate on urban agriculture issues in Toledo OH. ARS and CIFT developed a team to address issues in urban agriculture. This team will 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. CIFT and EPA have remediated a site in Toledo and ARS is working with CIFT to develop a plan for growing crops at this site. ARS is working with EPA to establish a broader collaborative agreement to jointly address soil remediation issues and storm water utilization in urban environments.

- Due to difficulty in successfully licensing new biopesticides due to their "niche' market and high registration and production costs, ARS has collaborated with EPA to develop a more efficient and less costly system for the commercialization of ARS research on development of biopesticides. ARS and EPA have facilitated EPA registration of USDA-ARS National Biocontrol Laboratory (NBCL) in Stoneville, MS's "manufacturing facility." The NBCL will be modified to support pilot scale production of biocontrol microorganisms. The goal is that new biopesticides developed throughout ARS with CRADA partners

will collaborate with NBCL for pilot scale production. Those jointly developed pesticides will have a reduced registration cost from EPA. Further discussions with the Office of General Council have resulted in approval of formal CRADA and licensing agreement authorizes development and sale (by private sector) of products derived from CRADA.

- The President's Biofuels Interagency Working Group report Growing America's Fuels identified USDA as having a specific research leadership responsibility for the improvement and development of non-food biomass crops. In October 2010, five regional USDA Biomass Research Centers were established. A Memorandum of Understanding between ARS and FS was executed in FY 2010. This strengthened alliance is expected to involve ARS and Forest Service scientists across the USDA research locations and will complement research activities of the Regional Biomass Research Centers.

- Developed a Non-Funded Cooperative Agreement (NFCA) for the framework of cooperation between ARS, USDA's Office of Energy Policy and New Uses (OEPNU) and the US Department of Transportation's Federal Aviation Administration (FAA) to develop a Feedstock Readiness Level tool that provides information regarding the status of different supply chain components needed to produce biofuels suitable for use by jet aircraft.

METRICS ON USDA TECHNOLOGY TRANSFER ACTIVITIES

TABLE 1. Collaborative Relationships for Research & Development (R&D)

CRADA's and Other R&D

Agricultural Research Service (ARS) [1]	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
● **CRADAs**, total active in the FY	185	207	230	233	262
- New, executed in the FY	50	55	69	69	83
▪ Traditional CRADAs, total active in the FY	163	184	202	191	208
- New, executed in the FY	40	47	63	51	59
▪ Non-traditional CRADAs, total active in FY	22	23	28	42	54
- New, executed in the FY	10	8	6	18	22
▪ Material Transfer - CRADA, total active in the FY	7	5	3	10	16
- New, executed in the FY	2	2	1	7	10
▪ 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	7	10	12	15	18
- New, executed in the FY	1	3	3	5	7
▪ Foreign - CRADA, total active in the FY	7	7	12	16	19
- New, executed in the FY	2	3	2	6	5
● **Amendments**[2], total in the FY	73	77	76	74	91
● Scientific Germplasm Releases (Public & Protected)	N/A	N/A	N/A	58	86 [10]
● **Other Collaborative R&D Relationships**, total active in the FY[3]					
▪ Confidentiality Agreements					
- New, executed in the FY	227	329	270	251	246
▪ Material Transfer Agreements					
- New, executed in the FY	700 [5]	788 [6]	884 [7]	784 [8]	885 [9]
▪ Other Agreements, total active in the FY	3,477	4,084	5,466	9,960	11,214
- New, executed in the FY	676	1,159	1,729	1,381	1,273
● Animal and Plant Health Inspection Service (APHIS)					
▪ CRADAs, total active in the FY	2	3	3	4	3
- New, executed in the FY	2	1	0	1	1
▪ Material Transfer - CRADA, total active in the FY	1	7	10	16	20
- New, executed in the FY	N/A	6	3	3	3
▪ Confidentiality Agreements	N/A	12	16	22	33
- New, executed in the FY	N/A	4	4	6	11
● Forest Service (FS)					
▪ CRADAs, total active in the FY	8	20	19	22	22
- New, executed in the FY	5	13	7	9	15

Footnotes for TABLE 1

[1] Data for 2006 from APHIS & FS were originally reported with ARS CRADA data. APHIS & FS data is now separate & reflected in rows identified for their 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 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.

[9] Includes 633 processed for outgoing materials, representing research outcomes of interest to other researchers and private- sector companies.

[10] Includes 5 releases which originated outside of ARS (ARS invited to join in the release).

TABLE 2. Invention Disclosure and Patenting

Intellectual Property Management[1]

Agricultural Research Service (ARS)	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
● New invention disclosures in the FY	105	124	133	153	146
● Patent applications filed in the FY	83	107	114	117	106
▪ Non-Provisional	59	68	74	86	73
▪ Provisional	24	39	40	31	32
Forest Service (FS)	**FY 2006**	**FY 2007**	**FY 2008**	**FY 2009**	**FY 2010**
● New invention disclosures in the FY	N/A	2	0	1	18
● Patent applications filed in the FY	N/A	7	9	6	6
▪ Non-Provisional	N/A	5	5	4	3
▪ Provisional	N/A	2	4	2	3
● Patents issued in the FY	N/A	2	3	3	2

Footnotes for TABLE 2

[1] Includes data from APHIS. Includes data from FS through FY2006

TABLE 3. Licensing

Profile of Active Licenses [1]

Agricultural Research Service (ARS)	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
● **All licenses**, number total active in the FY	332	327	315	316	323
▫ New, executed in the FY	25	25	27	25	22
▪ **Invention licenses**, total active in the FY	332	327	315	316	323
▫ New, executed in the FY	25	25	27	25	22
- Patent licenses, total active in FY	316	327	291	288	292
▫ New, executed in the FY	20	24	23	21	18
- Material transfer (invention), tot l active in FY	16	22	24	28	3
▫ New, executed in the FY	5	5	4	4	4

Forest Service (FS)	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
● **All licenses**, number total active in the FY	N/A	12	13	13	20
▫ New, executed in the FY	N/A	0	1	0	0
▪ **Invention licenses**, total active in the FY	N/A	12	13	13	20
▫ New, executed in the FY	N/A	0	1	0	0

Footnotes for TABLE 3

[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.

TABLE 4

Income Bearing Licenses[1]

Agricultural Research Service (ARS)	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
● **All income bearing licenses**, number	330	337	313	314	321
▫ Exclusive	233	241	223	222	230
▫ Partially exclusive	32	24	20	20	16
▫ Non-exclusive	65	72	70	72	75
▪ **Invention licenses**, income bearing	330	337	313	314	321
▫ Exclusive	233	241	223	222	230
▫ Partially exclusive	32	24	20	20	16
▫ Non-exclusive	65	72	70	72	75
- Patent licenses, income bearing	314	315	289	286	290
▫ Exclusive	233	238	220	218	226
▫ Partially exclusive	32	24	20	20	16
▫ Non-exclusive	49	53	49	48	48
- Material transfer (invention) licenses, income bearing	16	22	24	28	31
▫ Exclusive	0	3	3	4	4
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	16	19	21	24	27
● **All royalty bearing licenses**, number [2]	100	106	112	129	125
▪ **Invention licenses**, royalty bearing	100	106	112	129	125
- Patent licenses, royalty bearing	93	101	104	120	113
- Material transfer (invention) licenses, royalty bearing	7	5	8	9	12

Footnotes for TABLE 4

[1] Includes data from FS.

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

TABLE 5

Licensing Management

Agricultural Research Service (ARS)	FY 2006[1]	FY 2007[2]	FY 2008[3]	FY 2009[4]	FY 2010[5]
● **Number of licenses**					
▪ **Invention licenses**, total active in the FY	332	339	315	316	323
▫ New, executed in the FY	25	25	27	25	22
● **Elapsed execution time**, licenses granted in the FY					
▪ **Invention licenses**					
▫ average (months)	11.2	8.9	4.8	6.7	6.6
▫ median (months)	7.6	8.2	5.0	6.8	6.4
▫ minimum (months)	2.3	2.6	0.5	0.7	0.7
▫ maximum (months)	27.7	23.7	11.4	18.4	18.5
- Exclusive and partially exclusive invention licenses					
▫ average (months)	14.3	11.6	7.3	9.7	5.7
▫ median (months)	15.0	9.3	6.6	7.9	5.6
▫ minimum (months)	3.9	3.0	3.9	5.5	2.3
▫ maximum (months)	27.7	23.7	11.4	18.4	9.2
- Non-exclusive invention licenses					
▫ average (months)	6.7	6.9	2.3	3.2	8.3
▫ median (months)	5.9	8.2	1.0	1.8	9.4
▫ minimum (months)	2.3	2.6	0.5	0.7	0.7
▫ maximum (months)	12.1	11.5	6.0	8	18.5
▪ **Patent invention licenses**					
▫ average (months)	12.1	9.6	7.2	8.2	6.1
▫ median (months)	7.6	7.2	6.0	7.3	5.6
▫ minimum (months)	2.3	2.6	3.9	1.2	2.3
▫ maximum (months)	27.7	23.7	11.4	18.4	11.9
- Exclusive and partially exclusive patent invention licenses					
▫ average (months)	14.3	11.6	7.3	10.1	5.3
▫ median (months)	15.0	9.3	6.6	8.4	4.8
▫ minimum (months)	3.9	3.0	3.9	5.5	2.3
▫ maximum (months)	27.7	23.7	11.4	18.4	9.2
- Non-exclusive patent invention licenses					
▫ average (months)	4.8	6.5	6.0	1.3	11.9
▫ median (months)	5.9	6.4	6.0	1.3	11.9
▫ minimum (months)	2.3	2.6	6.0	1.2	11.9
▫ maximum (months)	6.3	11.5	6.0	1.4	11.9
▪ **Material transfer (invention) licenses**					
▫ average (months)	8.2	7.3	1.8	4.4	7.6
▫ median (months)	8.4	9.2	0.6	4.7	8.5
▫ minimum (months)	3.9	3.0	0.5	0.7	0.7
▫ maximum (months)	12.1	9.2	5.8	8	18.5
- Non-exclusive material transfer (invention) licenses					
▫ average (months)	8.2	7.3	1.8	4	7.4
▫ median (months)	8.4	9.2	0.6	3.7	5.3
▫ minimum (months)	3.9	3.0	0.5	0.7	0.7
▫ maximum (months)	12.1	9.2	5.8	8	18.5
● **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 for TABLE 5

[1] 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.

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

[3] 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.

[4] 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.

[5] During FY 2010, USDA received 24 new invention license applications, for which 4 new licenses were granted, 16 license agreements are currently in negotiation, 3 applications were withdrawn by the applicants, and 1 application is on hold by request of the applicant. The FY 2010 data is based upon 14 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.

TABLE 6

License Income [1]

Agricultural Research Service (ARS)	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
● **Total income**, all patent invention licenses active in the FY	$3,161,869	$3,588,148	$3,953,415	$5,376,463	$3,641,476
▪ **Invention licenses**	$3,161,869	$3,588,148	$3,953,415	$5,376,463	$3,641,476
- Patent licenses	$3,100,219	$3,521,739	$3,883,922	$5,318,483	$3,566,048
Material transfer (invention licenses)	$61,650	$46,409	$69,493	$57,980	$75,428
▪ **Other IP Licenses**	$0	$0	$0	$0	$0
● **Total Earned Royalty Income** (ERI)	$2,337,323	$2,681,552	$3,009,774	$4,422,023	$3,075,199
▫ Median ERI	$5,000	$4,657	$4,258	$4,485	$4,911
▫ Minimum ERI	$18	$12	$7	$12	$2
▫ Maximum ERI	$230,296	$388,730	$761,553	$1,715,890	$331,674
▫ 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	$908,123	$1,230,251	$1,657,059	$2,756,811	$1,493,456
▫ ERI from top 20% of licenses	$1,879,229	$2,205,066	$2,543,565	$3,874,292	$2,540,101
▪ **Invention licenses,** total ERI	$2,337,323	$2,681,552	$3,009,774	$4,422,023	$3,075,199
▫ Median ERI	$5,000	$4,657	$4,258	$4,485	$4,911
▫ Minimum ERI	$18	$12	$7	$12	$2
▫ Maximum ERI	$230,296	$388,730	$761,553	$1,715,890	$331,674
▫ 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	$908,123	$1,230,251	$1,657,059	$2,756,811	$1,493,456
▫ ERI from top 20% of licenses	$1,879,229	$2,205,066	$2,543,565	$3,874,292	$2,540,101
- Patent (and patent application) licenses, total ERI	$2,301,172	$2,662,122	$2,982,281	$4,386,042	$3,014,771
▫ Median ERI	$5,194	$4,662	$4,579	$4,612	$5,000
▫ Minimum ERI	$18	$89	$45	$117	$2
▫ Maximum ERI	$230,296	$388,730	$761,553	$1,715,890	$331,674
▫ 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	$908,123	$1,230,251	$1,544,031	$2,756,811	$1,493,456
▫ ERI from top 20% of licenses	$1,854,214	$2,178,046	$2,485,319	$3,819,292	$2,485,208
- Material transfer (invention licenses), total ERI	$36,150	$19,430	$27,493	$35,980	$60,428
▫ Median ERI	$2,645	$3,428	$1,003	$3,186	$1,705
▫ Minimum ERI	$153	$12	$7	$12	$42
▫ Maximum ERI	$17,053	$9,784	$9,508	$13,690	$17,988
▫ ERI from top 1% of licenses	$17,053	$9,784	$9,508	$13,690	$17,988
▫ ERI from top 5% of licenses	$17,053	$9,784	$9,508	$13,690	$17,988
▫ ERI from top 20% of licenses	$17,053	$9,784	$18,573	$21,282	$32,711
Forest Service (FS)	**FY 2006**	**FY 2007**	**FY 2008**	**FY 2009**	**FY 2010**
● **Total income**, all licenses active in the FY	N/A	$46,080	$25,015	$6,655	$5,506
▪ **Invention licenses**	N/A	$46,080	$25,015	$6,655	$5,506
- Patent licenses	N/A	$46,080	$25,015	$6,655	$5,506

Footnotes for TABLE 6

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

[2] Represents a single license.

TABLE 7

Disposition of License Income [1]

Agricultural Research Service (ARS)	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
● **Income distributed**[2]					
▪ **Invention licenses**, total distributed	$2,561,281	$3,158,217	$3,013,552	$3,673,922	$3,137670
▫ To Inventors	$998,042	$1,015,450	$756,458	$1,371,346	$1,370,296
▫ To Others	$1,032,573	$1,344,186	$562,427	$1,633,536	$1,179,579
- Patent licenses, total distributed	$2,534,208	$3,114,853	$2,958,996	$3,631,660	$3,084,726
▫ To inventors	$982,756	$990,344	$728,892	$1,346,512	$1,341,289
▫ Salaries of some technology transfer staff	$1,020,786	$1,325,928	$1,535,437	$1,616,108	$1,155,642
▫ Patent filing preparation, fees, & patent annuity payments	$530,666	$798,581	$694,667	$669,040	$587,795
▫ Other technology transfer expenses	$0	$0	0	$0	$0
- Material transfer (invention) licenses, total distributed	$27,073	$43,364	$54,556	$42,262	$52,944
▫ To inventors	$15,286	$25,106	$27,566	$24,834	$29,007
▫ Salaries of some technology transfer staff	$ 1,787	$18,258	26,990	$17,428	$23,937
▫ 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 2006	FY 2007	FY 2008	FY 2009	FY 2010
● **Income distributed**					
▪ **Invention licenses**, total distributed	N/A	$15,890	$8,500	$6,000	$5,506
▫ To Inventors	N/A	$15,890	$8,500	$6,000	$5,506
▫ To Others	N/A	$0	$0	$0	$0
- Patent licenses, total Distributed	N/A	$15,890	$8,500	$6,000	$5,506
▫ To inventors	N/A	$15,890	$8,500	$6,000	$5,506
▫ To Others	N/A	$0	$0	$0	$0

Footnotes for TABLE 7

[1] Includes data from FS through FY 2006.

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

DOWNSTREAM OUTCOMES FROM ARS TECHNOLOGY TRANSFER ACTIVITIES

NATURAL RESOURCES AND SUSTAINABILITY

- 152 Research Projects
- 68 Locations
- 464 Scientists

USDA, AMS Process for Cotton Classification to Facilitate the Sale of USA Cotton into China

Cotton grown in the United States, and many other counties, must be classified according to its quality properties for processing and marketing evaluation. This method of classification, called High Volume Instrumentation (HVI), was developed by USDA, AMS (Agricultural Marketing Service) with technical support from ARS over many years. As China became a greater importer of U.S. cotton, they were determined to utilize a native classification system developed within their country over previous generations which was very labor intensive, costly, and not favorable to U.S. cotton. Dr. Xiaoliang Cui worked with AMS by providing technical information and perseverance to help bring about China's acceptance to adopt and utilize the USDA cotton classification system for measuring the properties of their cotton. The shift happened through the creation of contacts in the Chinese government and convincing various parties who oversaw the multidisciplinary system that utilization of the USDA protocols provided advantages that would encourage the safety and grading of cotton. This technology transfer outcome was achieved through public release of information, and won an ARS Superior Technology Transfer Award. *Cotton Quality and Structure Research, New Orleans, Louisiana*

Broadening the Genetic Base of Cotton to Increase Pest Resistance and Reduction of Production Costs in Commercial Varieties

Improvements in fiber quality traits such as strength, length, length distribution and Micronaire, along with the reduction in production costs would make U.S. cotton (*Gossypium hirsutum* L.) more competitive with both man-made fibers and global competitors. ARS' research has emphasized broadening the genetic base of cotton, improving fiber quality, introgressing genes for pest resistance, and improved yield in cotton. Most cotton species have nectar glands that attract insects to improve pollination. One wild cotton species is nectariless and possesses no nectar glands. The nectariless trait in wild cotton, *Gossypium tomentosum*, was first reported from Hawaii in the late 1800s. It remained a curiosity until through ARS researcher it was discovered that, contrary to most wild genes introduced into upland cotton, the nectariless trait genes were associated with increased yields and pest resistance. From the efforts of this research, there were spawned numerous germplasm releases including six commercial varietal releases and the publicly released variety, MD 51ne. *Crop Genetics Research Unit, Stoneville, Mississippi*

Practical Applications for 3-waveband Active Crop Canopy Sensor Technologies and Delivery to the Scientific Community and Producers

Farmers and ranchers have long used crop appearance as a measure of plant stresses and nutrient availability. Active crop sensor technologies that systematically characterize and quantify plant vigor (i.e., chlorophyll status and biomass) constitute using the crop as a bio-sensor of nutrient status. The goal was to develop an automated crop canopy sensor system that would provide real-time crop data that could be translated into on-the-go fertilizer nitrogen (N) recommendations. Intuitively, the in-season approach to N fertilization of crops like corn and wheat holds considerable environmental promise because it improves synchronization between soil N availability and crop N needs. Other implications include reduced nitrate leaching, better use of nutrients contained in manure and those mineralized from residues, and reduced greenhouse gas emissions when soil nitrate levels are reduced. Implementation of the in-season N management strategy requires regional interpretations translate sensor readings into fertilizer N recommendations. A marketing agreement with two industry partners was developed to commercialize the 3-waveband sensor in 2008. This technology transfer outcome was achieved through collaborations and public release of information. *Agroecosystems Management Research Unit, Lincoln, Nebraska*

Comprehensive Application Technologies and Strategies to Floral and Nursery Industry to Reduce Pesticide Use by 50% and Safeguard the Environment

The floral and ornamental nursery industry is the third largest commodity in U.S. agriculture, and its value at wholesale price reached $16.9 billion in 2006. To produce high quality crops, growers of floral and ornamental nursery crops depend on the use of pesticides to protect their crops. However, due to lack of user-friendly tools and guidelines for spray applicators, many spray application systems are never adjusted following purchase or are not optimized to match the specific plant targets. The lack of knowledge regarding pesticide spray coverage has lead to the over-application of pesticides in the industry for many years.

A comprehensive pesticide reduction technology to optimize spray application rates for plant canopies by simply changing spray nozzles on existing spray systems was developed and transferred to the ornamental tree nursery and floral industry. To develop this technology, ARS scientist formulated the parameters for tree canopy volume determination and the requisite amount of sprays required for the coverage, developed the strategies for sprayer calibrations and proper nozzle selection and a computer program for estimating spray drift potentials. The simplified sprayer calibrations with a user-friendly pressure gauge calibrator developed a portable scanning device for spray deposition quality evaluation and developed a step-by-step guideline specifically for tree crop spray applications. This technology transfer outcome was achieved through public

release of information. *Application Technology Research Unit, Wooster, Ohio*

Tools for Rapid Assessment of Nutrient Use Efficiency Across Diverse Dairy Farm Types in the US and Abroad

Escalating fertilizer and feed costs, great variation in milk prices, and increasing regulations to reduce nutrient loss have created new economic and environmental pressures to improve nutrient use in dairy production. On many dairy farms, it is possible to put more feed nutrients into milk and more fertilizer and manure nutrients into crops/pasture. Such improvements in Nutrient Use Efficiency (NUE) would reduce farm input costs, enhance profits, and have multiple positive impacts on the environment. Over the past several years, ARS scientists have demonstrated uncommon creativity and innovation in the development, application and transfer of tools to measure and monitor NUE. 'Snap-shot' tools for assessments of nutrient use range from confinement and grazing, large and small operation dairy farms in various geographic settings (U.S., China, Australia and India). 'Snap-shots' entail an initial 2-3 hour interview with the farm operator(s) to compile an overall picture of a farm, which includes 'snap-shots' of nutrient management for the period 'yesterday-today-tomorrow'. The information obtained during the first interview is used to establish initial NUE and to develop additional survey tools for subsequent farm visits, NUE monitoring and evaluation. Subsequent farm visits are set up to collect additional data, feed and manure samples, and to discuss survey results with producers. Data collection over 12-18 months on carefully selected, representative dairy farms can be used to provide 'snap-shots' of nutrient management for the dairy industry, as well as information on the range of feed and manure management practices on individual farms. 'Snap-Shot' tools for assessments of nutrient are used on a wide range of dairy farm types (confinement and grazing, large and small operations) in various geographic settings (USA, China, Australia and India). This technology transfer outcome was achieved through public release of information. *US Dairy Forage Research Center, Madison, Wisconsin*

Improved Plant Materials and Management Practices for Use in Rangeland and Pasture Agricultural Growing Environments

ARS Researchers develop improved plant materials and management practices for use in rangeland and pasture agricultural growing environments. Recent products include Siberian Wheat grass, Crested Wheat grass, Russian Wildrye grass, Slender Wheat grass and Meadow Brome grass. These products provide solutions to problems associated with conservation, reclamation, restoration, and forage production. These improved plant materials reduce the incidence of rangeland wildfires and increase productivity of rangelands and pastures. One of the primary reasons for their rapid adoption by public land agencies and private landowners is their improved establishment and persistence characteristics in hard growing environments. Based on Foundation seed sales and certified seed, production revenue is in excess of $4,000,000. Annual seed sales of two Slender Wheat grasses are as high as $3.2 million. These cultivars are currently being recommended for use on 42 military facilities in the western U.S. that occupy 3.5 million acres. In fact, these improved cultivars were also a major component in the reseeding mixtures for the repair of 2.5 million acres of rangeland that burned in the Great Basin during the summer of 2007. This technology transfer outcome was achieved through university licensing mechanisms.

Forage and Range Research Laboratory, Logan, Utah

Database of Ammonia and Hydrogen Sulfide Emissions for Cattle Feedyards in the Nation

On December 18, 2008, the U.S. Environmental Protection Agency ruled the Emergency Preparedness and Community Right-to-know Act (EPCRA) required the cattle feeding industry to report emissions of ammonia and hydrogen sulfide to state and local emergency responders. Feedlots failing to report could be fined $25,000 per day and face potential criminal liability.

At the request of the National Cattlemen's Beef Association (NCBA) and the Texas Cattle Feeders Association, collaborative researchers from USDA-ARS, Texas AgriLife Research in Amarillo, TX, and West Texas A&M University in Canyon, TX responded. The Research Team had been collaborating on a federally-funded research project that investigated cattle feedlot air quality. A major product of this research was the most extensive database of ammonia and hydrogen sulfide emissions for cattle feedyards in the nation. The team submitted a report to the cattle industry associations representing the state of the science and best estimates of ammonia and hydrogen sulfide emissions from cattle feedlots. The research-based guidelines for beef cattle ammonia and hydrogen sulfide emissions in the report were adopted by NCBA, and producers were instructed on how to comply with the EPCRA reporting requirement. Ben Weinheimer, vice president of the Texas Cattle Feeders Association, stated "we safely can estimate that 95% of all the reports filed in the U.S. utilized the results and summary provided by USDA-ARS to file the one-time reports under

EPCRA." This technology transfer outcome was achieved through public release of information. *Conservation and Production Research Laboratory, Bushland, Texas*

Spray Application Technology

The Asian citrus psyllid (*Diaphorina citri*, Sternorrhyncha: Psyllidae) is a detrimental pest to citrus (*Citrus* spp.) crops when it serves as a vector of the pathogen that causes greening (huanglongbing). Transmission of this disease causes mottling, chlorosis, dieback and reductions in both fruit size and quality. Due to the threat of greening, several pesticides have been granted special local needs registration for use in Florida if the product is sprayed with a volume median diameter of 90 microns or greater. Leaders of the U.S. citrus industry met with ARS administrators to seeking help on these research priorities. Spray application technology was identified as one of the areas where ARS could help the industry. The ARS group traveled to Florida and determined the best course of action was to conduct a series of sprayer evaluation clinics around the state helping applicators set up their sprayers to comply with the 90 micron spray droplet requirement. This allowed the ARS team to transfer their knowledge and experience regarding spray atomization and sprayer configuration to the citrus industry. The equipment represented the most typical application equipment used in Florida for psyllid control. These results will provide applicators, growers, and extension agents, who work with citrus applicators, with general guidelines to ensure spray systems are operated in a manner that complies with label restrictions. The results from the sprayer clinics were published in a trade magazine, *Florida Grower*, and in a peer reviewed journal *Hortechnology*, "This effort will literally save Florida growers at least $25 million a year and assure application efforts are in line with label guidelines, thus minimizing drift issues." This technology transfer outcome was achieved through public release of information. *Pest Management Research Unit, Sidney, Montana*

Process for Removing and Recovering Phosphorus from Animal Waste

This technology converts the nutrients in animal wastes into value-added and marketable end products such as plant fertilizer, which generates a new source of income to the producer and decreases environmental problems associated with intensive animal production. The aspect of phosphorus reuse in this technology is important for the fertilizer industry because the world phosphorus reserves are limited. According to the Potash and Phosphate Institute, the U.S. annual consumption of inorganic phosphorus for crop production is about 3,700 million pounds. On the other hand, according to USDA-NRCS, the U.S. as a whole, confined livestock produces 1,329 million pounds of recoverable manure phosphorus annually with 70% (925 million pounds) in excess of on-farm needs. Therefore, reuse of phosphorus recovered from animal wastes using this invention could substitute 25% of the phosphorus now obtained from mining. This technology was licensed to an industry partner in 2010, and received a Federal Laboratory Consortium (FLC) National Technology Transfer Award. *Coastal Plain Soil, Water and Plant Conservation Research Unit, Florence, South Carolina*

System for Delivering Poultry Litter Below the Soil Surface

Research has shown that nutrient losses from poultry litter applied to farmland are minimized if the litter is incorporated by applying it in shallow trenches beneath the soil surface. Development of a single-shank, tractor-drawn implement has proven that the incorporation technique can be mechanized, but making this technology a practical option for producers requires a multiple-shank litter incorporator. All of the shanks must simultaneously receive a steady supply of dry poultry litter particles small enough to flow easily through the shank portals, so an effective litter distribution system will be an essential component. To meet this need, ARS invented an auger system that can pulverize dry poultry litter while transporting it from a bulk bin through rectangular openings whose size and location simulate shank portals. This system provides effective litter distribution and eliminates the need for pre-treating (grinding) the litter before loading, thus removing a major obstacle to adoption of the technology by producers. Excessive nutrient losses cost producers substantial income, and severely degrade air and water quality in many watersheds with intensive poultry production. This technology was licensed to an industry partner in 2010. *Dale Bumpers Small Farms Research Center, Booneville, Arkansas, in cooperation with Pasture Systems and Watershed management Research Unit, University Park, Pennsylvania, and the National Soil Dynamics Laboratory, Auburn, Alabama*

BIOENERGY AND BIOPRODUCTS

- 133 Research Projects
- 29 Locations
- 257 Scientists

Develop Technology Enabling the Mid Atlantic Winter Barley Ethanol Industry that is Benefiting Energy Independence, the Environment, and the Rural Economy in the U.S.A.

ARS began the concept in 2001 when farmers had the capacity to grow winter barley in the Mid-Atlantic States but there was no market for it. Farmers there desperately needed additional farm revenue from new crops to survive the difficult economic times. There was also a huge demand for fuel ethanol on the East Coast, but no corn. The industry preferred feedstock, because local corn was needed to feed dairy, swine, and poultry in the area and using more for ethanol would put severe pressures on corn supplies and local markets. Fuel ethanol for the East Coast was grown in the Midwest and railed to the East, requiring much energy and cost for transport. A concept of using winter barley as an East Coast ethanol feedstock was developed, but there were many problems to solve: 1) East Coast growers had stopped growing barley because of a lack of market; 2) barley was known as a poor feedstock for ethanol by all the experts due to a lack of high-starch barley varieties that would produce economic yields of ethanol; abrasiveness of barley hulls

caused wear and tear on handling and ethanol plant process equipment; and presence of viscous beta-glucans in barley made grinding, mixing with water and heating (mashing) almost impossible; 3) lack of entrepreneurial small businessmen to take new technology and commercialize it. ARS researchers along with University support and an industry CRADA partner put in place a number of development steps between 2001 and 2010 to develop the technology and educate East Coast farmers to the value of growing barley for ethanol production. The first Bio Energy producer started operations this year. Over 500 construction jobs were created over the last year and one half, with over $150 million in procurement, labor, utilities, etc. Fifty new permanent jobs will be created to staff the biorefining plant and 44 of those have already been hired. This technology transfer outcome was facilitated through a combination of CRADAs, and a field-to-fuel consortium of university / federal / private sector researchers. This technology also won an ARS Superior Technology Transfer Award, and an FLC Mid-Atlantic Region Technology Transfer Award. *Sustainable Biofuels and Co-products Research Unit, Wyndmoor, Pennsylvania*

Better Permeation Membranes for Biofuels Production

Fermentation of biomass to ethanol or butanol currently results in a very low concentration in the broth, and recovery by distillation becomes inefficient due to the increasingly large amount of energy required at lower concentrations. ARS scientists invented a novel membrane permeation system that exhibits significant improvements over current membranes and provides a lower energy alternative to distillation. A patent application has been filed on a membrane fabrication technique that provides thin, multi-layer membranes with improvements in both the throughput and the concentration of the product that permeates through the membrane. This invention brings membrane permeation closer to commercial realization for biofuels production from biomass. This technology transfer outcome reflects a pending patent for potential licensing. *Bioproduct Chemistry and Engineering Research Unit, Albany, California*

Improved Breakdown of Biomass Using Enzymes that Target Cell Wall Crosslinkages

ARS scientists have successfully cloned and expressed genes of several key enzymes from microorganisms responsible for the hydrolysis of various covalent crosslinkages in plant cell wall, including glucuronoyl esterase, xyloglucanase, arabinanase, in addition to the previous studied feruloyl esterase. In combinations they could enhance the extent and efficiency of lignocellulosic hydrolysis and utilization of all available sugars in biomass conversion. This technology transfer outcome was achieved through use of CRADAs and patents. *Bioproduct Chemistry and Engineering Research Unit, Albany, California*

Development of a Commercially Viable Process for Production & Recovery of Ethanol, Limonene & Residue Products from Citrus Waste

Approximately 80% of the citrus fruit produced in Florida is processed into juice products generating 3.5 to 5 million tons of wet peel and pulp waste, or approximately 700 thousand to 1 million tons dry waste residue per year. Traditional use for the bulk of this residue is as cattle feed. Typically citrus pulp pellets, as a cattle feed additive, have not had sufficient value to cover production and transportation costs. With the low profit margins realized for citrus juice solids, this presents a tremendous economic and disposal problem for the citrus processing industry. ARS scientists have partnered with an industry partner to further development of a process for pre-treating and fermenting citrus processing waste residues to produce ethanol and recover better than 90% of the d-limonene present in the citrus waste. This work has resulted in the development of two CRADAs, patents, and a pilot plant for ethanol production. The work completed on this project is a big step towards developing an economical process. *Citrus and Subtropical Products Laboratory, Winter Haven, Florida*

SUSTAINED FOOD PRODUCTION

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

New Potato Varieties in the Pacific Northwest

Numerous new potato varieties have been developed by a research collaboration, called the "Tri-State," involving ARS, the potato commissions of Idaho, Oregon, Washington, and researchers at the University of Idaho, Oregon State University, and Washington State University. Thirty-three new varieties have been optimized for nutritional value, pest and disease resistance, and use by various market segments such as fresh pack, chipping, and processing. They are an important contribution to maintaining the economic health of the potato industry in the Pacific Northwest. In the past few years, many of these varieties have been protected by Plant Variety Protection Certificates and licensed to the Potato Variety Management Institute (PVMI), formed in 2005 by the Potato Commissions of the states of Idaho, Oregon, and Washington. PVMI has licensed numerous potato varieties from ARS and is aggressively marketing these varieties, not only in the Pacific Northwest, but throughout the world. This technology won an ARS Outstanding Technology Transfer Award an FLC Far West Region Technology Transfer Award. *Small Grains and Potato Germplasm Research Center and Vegetable and Forage Crops Production Research Unit, Aberdeen, Idaho and Prosser, Washington*

Application of Commercial Dextranase Enzymes in both U.S. Sugar Cane and Sugar Beet Processing for Cost Savings

The major source of sugarcane deterioration in the U.S., particularly in Louisiana where humid and warm conditions prevail, is from *Leuconostoc* bacterial infection. *Leuconostoc* deterioration is responsible for the formation of dextran, a viscous polysaccharide that serves as an impediment to downstream processing at a factory. Moreover, the factory processors are penalized by refiners for high concentrations of dextran in raw sugar. Before 2005, addition of dextranases at the factory to hydrolyze dextran was not working, in part because of misinformation in the industry about which commercial dextranase to apply and how and where to add the enzyme. The activities of commercial dextranases could *not* be directly compared because there was no uniform method used by vendors and/or distributors to measure or quote the activity. Louisiana sugar processors approached ARS to solve this problem. A major constraint to the full adoption of this technology was the highly conservative nature of the sugar industry. Most commercial dextranases were shown to be available in the U.S. in "non-concentrated" or "concentrated" forms, with huge variations (up to 20-fold) in activity existing that do not reflect the relative costs of the enzymes. Before this technology was transferred to industry, only "non-concentrated" dextranases were traditionally applied to evaporator syrups or juices in the factory. The technology has been knowingly transferred to 7 out of the 11 Louisiana sugarcane factories, and also to at least one Florida factory. Novel applications of a working solution of "concentrated" dextranase to heated juice were shown to be considerably more efficient and economical than adding them to evaporator syrups. Furthermore, under factory storage conditions, over a 90-day processing season typical of Louisiana, the activity of "concentrated" dextranase decreased only slightly, whereas "non-concentrated" dextranase activity was approximately halved, which also has important economic implications for the factory. This technology transfer outcome was achieved through public release of information, and won an FLC Southeast Region Technology Transfer Award. *Commodity Utilization Research Unit , New Orleans, Louisiana*

Rapid Response to H1n1 Pandemic Influenza by Timely Development and Transfer of Diagnostic Tests for Veterinary Specimens

When swine origin H1N1 influenza (pH1N1) was first identified, its importance in the infection of livestock and poultry, which can be infected with many influenza strains, was unknown. Therefore there was a critical need for a rapid and accurate diagnostic test for veterinary specimens, for use in veterinary diagnostic laboratories, that could quickly identify and differentiate the pH1N1from other influenza viruses. The H1N1 Pandemic Influenza Veterinary Diagnostic Test Development Team developed and validated a real-time RT-PCR test for field application in a very short time and transferred the protocols to

the National Animal Health Laboratory Network and to a number of international laboratories where they are in common use. This technology transfer outcome was achieved through use of Material Transfer Agreements, and won an ARS Superior Technology Transfer Award. *Southeast Poultry Research Laboratory, Athens, Georgia*

Commercialization of a New 'Super Lure' to Safely Control an Important Insect Pest in Home Gardens and Organic Farms

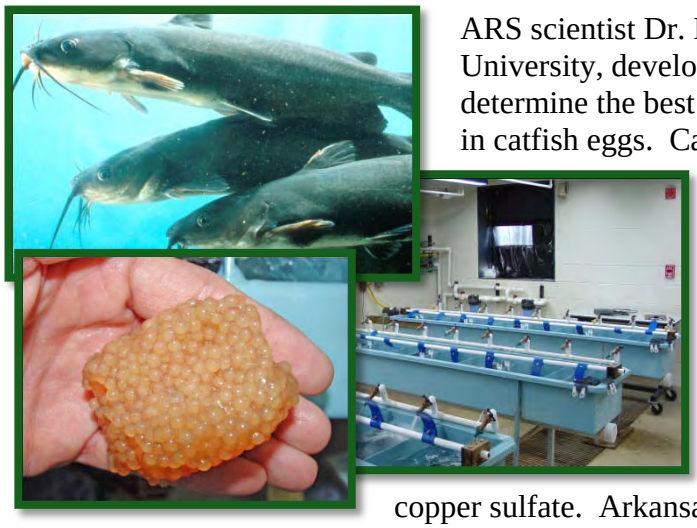
Pest insect resistance to insecticides is increasing, and the use of chemical insecticides for pest management is less safe and desirable than use of biological control. However, commercial biocontrol agents are expensive and often do not remain in areas where they are released. Identifying pheromones of generalist predators and using these attractants to induce wild female predators to lay eggs in targeted pest infestations is a novel and relatively inexpensive biocontrol strategy. Native pests, plus invasive pests such as the soybean aphid and mites, are ever-present agricultural threats, but importation of foreign beneficials to combat these pests is strictly regulated. Therefore, managing native predators is more important than ever, especially generalist predators that have large, widespread populations because they feed on a variety of prey. To date, the vast majority of research on insect behavior-modifying chemicals (i.e. semiochemicals) has focused on pest species and because of the specificity of pheromones, the market for pheromones of pests has been limited. In contrast, the market for pheromones of generalist predators are defined by the number of pest species on which they prey. In addition, discovery and implementation of male-produced aggregation pheromones of generalist predators to attract and induce female predators to lay eggs near pests yields an army of predators that search for nearby prey. This type of semiochemically enhanced biocontrol to lure predators is a much more direct and effective method of pest control than use of pest pheromones. The technology transfer effort, through CRADA and licensing mechanisms, resulted in a much-needed, commercial product that has been available to home owners nationwide. This technology also won the Beltsville Areas Paul Doraiswamy Technology Transfer Award. *Invasive Insect and Biocontrol and Behavior Laboratory, Beltsville, Maryland*

Tifguard, the First High Yielding Peanut Cultivar with Resistance to Both the Peanut Root-Knot Nematode and Tomato Spotted Wilt Virus

The peanut root-knot nematode and tomato spotted wilt virus (TSWV) are diseases of peanut that result in large yield losses in the Southeastern United States. Peanut varieties were available that had resistance to either the peanut root-knot nematode or TSWV, but no varieties were available with resistance to both pathogens. One objective of the ARS peanut breeding program in Tifton, Georgia was to combine resistance to both pathogens in a single variety. ARS researchers along with researchers from the University of Georgia develop "Tifguard," a new peanut variety. Tifguard has high yield and excellent resistance to both the peanut root-knot nematode and TSWV. This variety, for which a Plant Variety Protection Certificate (No. 200800404, filed 09/18/2008) is pending, is particularly valuable for peanut growers who have to deal with both diseases. Tifguard was released in 2008, and 2 % of the certified seed acreage in Georgia that year was planted in Tifguard. Based on the demand for

Tifguard, this was increased to 15.5 % in 2009 (an increase of almost 8 times over 2008 acerage), making Tifguard the second leading cultivar in terms of certified seed acreage, within 2 years of release. This technology transfer outcome was achieved through use of licensing mechanisms, and also won an ARS Superior Technology Transfer Award and an FLC Southeast Region Technology Transfer Award. *Crop Genetics and Breeding Research Unit, Tifton, Georgia*

New Hatching System to Control Fungal Infection in Catfish Eggs



ARS scientist Dr. David Straus and Dr. James Steeby, from Mississippi State University, developed an experimental hatching trough system that was used to determine the best concentration of copper sulfate to control fungal infections in catfish eggs. Catfish farmers are interested in a safe, low-cost alternative to the current FDA approved treatment options. The cost savings of treating eggs with the recommended rate of copper sulfate is considerable. In addition, copper sulfate does not have the human safety concerns or storage precautions of other approved compounds. Feedback from hatchery managers using copper sulfate has been overwhelmingly positive. Approximately 70% of all commercial catfish are hatched in Mississippi and at least half of their commercial catfish hatcheries are using copper sulfate. Arkansas produces approximately 20% of all commercial catfish and three of the four hatcheries use copper sulfate. The group is working toward FDA approval of copper sulfate to control fungus in earthen catfish ponds. This technology transfer outcome was achieved through public release of information. *Stuttgart National Aquaculture Research Center, Stuttgart, Arkansas*

A Novel System that Enables Rapid and Accurate Estimation of Stored Grain Insects in Wheat

ARS Researchers conceptualized and developed a novel system enabling rapid (~1 minute) and accurate estimation of stored grain insects in wheat. The device operates on the basis of crushing wheat between two rotating rollers. An electrical circuit attached to the rollers monitors the electrical current traveling from one roller to the other as wheat is crushed. If an insect is inside of a kernel, it will be crushed and emit hemolymph which is highly conductive, causing a brief spike in electrical current. ARS scientist developed computer signal processing software to detect these spikes in electrical current and count the number of live insects in a sample. Technology for this device has been transferred to the industry and is widely available to other grain handlers, marketers, and millers. The instrument is now part of a product line used by

industry and is being tested for its applicability to rice, sorghum, barley and corn. This technology transfer outcome was achieved through public release of information. *Center for Grain and Animal Health Research, Manhattan, Kansas*

Genetic Evaluation of Angus Cattle for Carcass Traits

ARS Researchers have worked closely with the American Angus Association to implement a new genetic evaluation of Angus cattle for carcass traits. Prior to this collaboration, there were separate carcass and ultrasound poly-genic genetic predictions (expected progeny differences or EPDs), and single gene tests were in place for Angus breeders to use to make genetic progress. Genetic parameter research allowed combined analysis of ultrasound and harvest data providing Angus breeders and commercial cattle producers with a single set of carcass trait EPDs. This approach resulted in a truer picture of differences in genetic merit than had ever been available for Angus cattle. This national cattle evaluation system approach in place produces the most accurate set of EPDs in a simple format reducing confusion to cattle producers. Enhancements to the carcass EPDs in the weekly incorporation of genomic results, as well as phenotypic data provides breeders with the most real-time accurate information available in the industry to date. Genetic trends in carcass traits resulting from the American Angus Association national cattle evaluation have added an estimated $3.6 million annually to the U.S. beef industry. This technology transfer outcome was achieved through public release of information, and won an FLC Far West Region Technology Transfer Award. *Livestock and Range Research Laboratory, Miles City, Montana*

An Environmentally Friendly Dehairing Process

Cattle hides are the most valuable co-product of the meat packing industry. This country produces about 40 million cattle hides annually, and the American tanning industry adds significant value to those hides by converting them into leather. Before the animal hides can be converted to leather they need to undergo a dehairing process. Traditionally sulfide is used to dehair bovine hides. However, sulfide poses both a health hazard and an environmental hazard. Tanners have expressed urgency in eliminating sulfide from the tannery. The ARS Eastern Regional Research Center (ERRC) leather group has developed an oxidative dehairing process, which readily removes hair from cattle hides leaving them clean and ready for a typical tanning process, and eliminates the use of sulfide in the tannery and waste stream. The team is presently carrying out dehairing research under a CRADA with a major domestic tannery. The results of this research should demonstrate a benign alternative to sulfide for the American tanning industry allowing for further adoption of the technology. *Biobased and Other Animal Co-Products Research Unit, Wyndmoor, Pennsylvania*

Methods for Preparing Isolongifolenone and its Use in Repelling Arthropods

Human diseases vectored by blood-feeding arthropods represent a serious threat to public health worldwide. More than 700 million cases of mosquito transmitted disease have been reported annually. Over 3 million people live under the threat of malaria, which kills over a million each year. In the United States, West Nile virus was transmitted to more than 8,000 people from 1999-2005, resulting in over 780 deaths. Deet is considered to be the best insect repellent ever developed, and is the most widely used insect repellent worldwide with a one million dollar annual-sales market. ARS' laboratory bioassays demonstrated that isolongifolenone is more efficient than Deet as a repellent against ticks and mosquitoes. The high-repellent efficiency of this compound will attract wide acceptance and use by the general public and military. Therefore, isolongifolenone has the potential to displace Deet in the worldwide repellent market. This technology was licensed to an industry partner in 2010.
Invasive Insect Biocontrol and Behavioral Laboratory, Beltsville, Maryland

Food Safety and Nutrition

- 115 Research Projects
- 25 Locations
- 300 Scientists

Predictive Microbiology Information Portal (PMIP) to Enhance Food Safety of the Nation's Food Supplies

To ensure the safety of our Nation's food supply, the Food and Drug Administration (FDA) and the United States of Department of Agriculture (USDA) establish food safety regulations to govern the manufacturing and distribution of domestic and imported food products. Food products must meet these regulations in order to be marketed in the US. However, these regulations are often complicated and misunderstood even by large food companies, which have financial resources to employ food safety experts to interpret and help them comply with the regulations. Small and very small food producers are often unable to understand and comply with food safety regulations, which result in limited production volume or closing of businesses.

In 2007, the Predictive Microbiology research group embarked on a project to create the Predictive Microbiology Information Portal (PMIP) on the world-wide web to help food producers, especially small and very small producers, and food safety researchers better access food safety information, regulations, and tools to help them address food safety questions at no cost. The PMIP is internet-based and free, and it provides a wide range of food safety-related information such as regulations, microbiological models, and microbiological data. The portal is open to the public, and can be accessed at http://portal.arserrc.gov/. Once into to the portal, users can quickly find regulations through user-friendly, easy-to-use, pull down menus or by point-and-click food

products, microorganisms, and information they are interested in. They can also access microbiological models and databases to estimate the safety of their products. PMIP has been accessed 1.45 million times from more than 12,000 unique IP addresses around the world. This technology transfer outcome was achieved through public release of information, and won an ARS Superior Technology Transfer Award, and an FLC Mid-Atlantic Region Technology Transfer Award. *Residue Chemistry and Predictive Microbiology Unit, Wyndmoor, Pennsylvania*

Developing, Implementing and Distributing an Improved Emergency Aid Food, the Instant Corn Soy Blend (ICSB), a Fully-Cooked Food Product in Distribution in Haiti

Over the last 50 years the Food-for-Peace program, through Title II of Public Law 480, has distributed foods to people overseas at risk of hunger and malnutrition, providing nutritionally balanced meals in times of emergency. The USDA FSA administers the Food-for-Peace program, buying U.S. grown commodity products which are in-turn handed over to the United States Agency for International Development (USAID). USAID distributes the foods through Non-Governmental Organizations (NGO's). The meals are supplied as uncooked fortified corn- or wheat- soy blends, with oil, vitamins and minerals. These uncooked Corn Soy Blend (CSB) meals have had many problems ranging from off-flavors (products going stale due to rancid fats), segregation of particles which intensifies malnutrition (vitamins and mineral settling to the bottom of the bag), and off colors (as vitamins and iron react with starch, protein, and fat under high temperatures in tropical countries). The team developed a fully-cooked product which required implementation of a policy to purchase, distribute the new product, and transfer the process and product to AbilityOne, a company hiring the severely handicapped. This is first time the USDA Farm Service Agency (FSA) has issued a product request for a new emergency food, which is Instant Corn Soy Blend (ICSB). USDA researchers have collaborated to deliver a novel emergency aid product for needy populations all over the world. This technology transfer outcome was achieved through public release of information, and won an FLC Mid-Atlantic Region Technology Transfer Award.. *Dairy and Functional Food Research Unit, Wyndmoor, Pennsylvania*

Antibodies Essential to the Manufacture of Improved Toxin Detection Assays

Mycotoxins (toxins produced by fungi) can cause devastating economic effects by reducing the safety and marketability of grain, and by causing disease in livestock. Diagnosis of health problems caused by mycotoxins is often difficult because while certain toxins can cause acute disease, most cause sub-acute or chronic effects are more difficult to discern. Furthermore, the presence of mycotoxins frequently causes problems for exporters of U.S. grain. For these reasons, attempts are made to detect mycotoxins at the many stages from crop production to the finished product. A vital part of mycotoxin control is the availability of rapid, accurate, sensitive, and cost effective methods for toxin detection and quantitation. Antibodies continue to be the preferred binding component for the majority of toxin detection methods because of their high

specificity and ability to be adapted to numerous test kit formats. For commercial applications, large amounts of well-defined antibodies with high performance characteristics are needed. The development of antibodies with sufficient sensitivity and specificity for use in modern applications requires experience and ingenuity. Through ARS researchers the availability of these materials has allowed greater screening of commodities and foods for these natural toxins and has helped improve the performance and minimized the costs associated with such screening. Since 2004, a total of 17 biological material licenses have been signed (with another two pending) for 7 different hybridoma cell lines, specifically those producing antibodies against aflatoxins, zearalenone or deoxynivalenol, which are widespread contaminants in agricultural commodities. This technology received an ARS Outstanding Technology Transfer Award, and FLC Mid-Continent Technology Transfer Award. *Bacterial Foodborne Pathogens and Mycology Lab, Peoria, Illinois*

A Direct Polymerase Chain Reaction Assay, or Bio-PCR

ARS scientists have developed a novel Polymerase Chain Reaction (PCR) technique which can specifically detect viable cells of a target microorganism in most any environmental sample desired. To accomplish this researchers combine a biological preamplification on a common growth medium with direct PCR. Samples are plated onto a general plating medium that allows for maximum growth of the target organism. After 6-48 hours, depending upon the organism, the plate is washed with 3 ml of water and a 35 ul sample used for PCR, stored for later use, or shipped to a central PCR laboratory. No DNA extraction is needed. This makes the technique simple and eliminates use of hazardous chemicals. Amplified products can be detected by gel electrophoresis or ELISA based fluorescence. Liquid medium could be used. However, a major disadvantage is PCR inhibitors would not be eliminated completely. This technique should have a major impact on routine sampling of seed, food, water, soil, and sewage samples for pathogens. This technology was licensed to an industry partner in 2010. *Foreign Disease-Weed Science Research Unit, Ft. Detrick, Maryland*

Methods for Detection of 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 other *E. coli* serogroups including O26 and O111 also produce Shiga toxins and cause a similar illness in humans as *E. coli* O157:H7. Methods for detection of *E. coli* O157:H7 in food

have been developed. However, it is difficult to detect the non-O157 STEC serogroups because these bacteria are difficult to distinguish from non-pathogenic *E. coli* strains. Therefore, at the request of the USDA Food Safety and Inspection Service (FSIS), methods were developed by ARS scientists to detect these non-O157 STEC in beef, as well as the potential in other foods. The methods involve enrichment in a growth medium suitable for increasing the numbers of O157 and the non-O157 STEC serogroups 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 (virulence genes and O-serogroup-specific genes). The detection of the amplified products is accomplished in real-time because fluorescent dye-labeled probes specific for the amplified products are used in the PCR assay. The detection and isolation protocols will soon be used in national surveys by the FSIS to determine the presence of these important emerging pathogens in beef. Based on the data obtained, new regulations regarding the presence of these pathogens in food will be established. The ultimate goal is to enhance food safety for the consumer. This technology transfer outcome was achieved through public release of information. *Molecular Characterization of Foodborne Pathogens Research Unit, Wyndmoor, Pennsylvania*

DOWNSTREAM OUTCOMES FROM ARS & FS TECHNOLOGY TRANSFER ACTIVITIES

ARS scientist from the Rangeland Resources Research Unit, Pasture, Forage and Range Land Systems, (Cheyenne, WY / Ft Collins, CO) provided a webinar to nine Field Offices of the US Forest Service National Grasslands on March 21, 2010. This webinar showcased key findings from ARS' research at the Central Plains Experimental Range and their impacts to public lands management, with particular emphasis to National Grasslands. ARS continued discussions for additional collaborative research efforts on several of these National Grasslands issues. In addition, the publications are being sent to David Wheeler, the National Grassland Ecosystems Research Liaison, for distribution to the Forest Service personnel. This technology transfer outcome was achieved through public release of information.

DOWNSTREAM OUTCOMES FROM FS TECHNOLOGY TRANSFER ACTIVITIES

Photo: http://www.wfmrda.org/

Tom Zimmerman, Program Manager for the Wildland Fire Management, Research, Development and Application Program, and part of the Science Applications and Integration staff, has been selected to receive the Chief's Honor Award for Science and Technology. The 2009 Chief's Honor Awards are awarded based on the Chief's strategic goals. The Science and Technology Award is awarded to someone who has provided outstanding Science-based applications and tools for

sustainable natural resources management. For more than 3 years, Dr. Zimmerman has lead the development of a highly successful national Research, development and application unit at RMRS to deliver technology, tools and decision support models to the interagency fire management community across the United States. As a result of the successful operation of this fire science and management unit, a national fire decision support center was created in 2009 in the Forest Service, where consistent methodology, systems and protocols will be used for all large-scale fire decision making and monitoring in the U.S. Dr. Zimmerman was instrumental in providing analytical and strategic advice for the national center and he is currently leading implementation efforts in the decision-support area, including a 3-fold increase in staffing. Tom builds strong relationships with collaborators and stakeholders, has recruited a talented workforce and carries out his leadership role with expert knowledge and strategic thinking, as well as personal warmth and humility.

New "Green" Adhesive for Wood Composites

Traditional plywood, particleboard, and other composite products made from petroleum-based adhesives release harmful formaldehyde vapors, a potential human carcinogen.

Formaldehyde fumes from these materials can also cause short-term symptoms such as watery eyes, burning sensations in the eyes, nose and throat, and skin irritation, especially in sensitive people. Charles Frihart, Ph.D., a research chemist at the U.S. Forest Service's Forest Products Laboratory (FPL), led a joint research effort with FPL and Ashland Hercules Water Technologies to develop a new adhesive that contains soy flour, a special water-resistant additive, and other modifiers. Together these ingredients form a polymer glue used for interior wood products such as decorative plywood and engineered wood flooring. This new glue performs as well as the existing petroleum adhesives, but does not contain formaldehyde. New regulations on reducing formaldehyde emissions from wood composites and the need to meet green building standards are strong driving forces behind the research. Further development of soy adhesives is continuing under the partnership between FPL and Ashland Hercules. The team has one issued patent, several patents pending, and their joint efforts have received additional support in the form of grants from the United Soybean Board. This technology transfer outcome was achieved through CRADA and license.

Improved Reforestation Using a Single Tool

Compacted soil can be a reforestation deterrent, either reducing seedling growth or killing seedlings. Forest Service inventors developed a sub-soiling apparatus that consists of shanks that are attached to a grapple rake or an excavator bucket. The grapple rake allows for two separate reforestation activities, piling of harvest residues for burning and reducing compaction. The excavator bucket allows for watershed restoration activities such as, recycling of gravel, culvert removal and road obliteration. All work is performed by an excavator simultaneously, in many cases eliminating the need for other heavy equipment; reducing project duration, cost and site entries. This technology transfer outcome was achieved through two patents available for licensing.

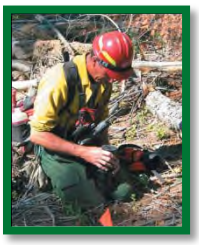
Environmentally Friendly and Cost-Effective Weed Control

This patented combination foliage compaction and treatment method for applying fluids such as herbicides to plants uses a large heavy roller that is pulled across a field of plants compacting the targeted weed species to the ground. A height adjustable applicator nozzle following the roller allows fluid to be released very near the plants, which increases the amount of fluid transferred to the plants' surface and lowers the amount of fluid sprayed into the atmosphere. This reduces the amount of fluid required to treat a given area. The "crush and spray" invention results in reduced fluid costs and waste, improved environmental impact, and increased treatment effectiveness. This technology transfer outcome was achieved through patents available for licensing.

Non-Toxic Biocide for the Prevention of Mold Growth, Decay and Insect Infestation of Wood

Wood is used in the construction of the majority of U.S. homes. Lumber and other wood-based materials are susceptible to attack by insects such as termites, wood decay fungi, and mold fungi, which affects indoor air quality and poses health concerns. Most current treatments for these problems are not safe for indoor use and do not address all three types of problems. Forest Service employees have invented (patent) a biocide composition for treating wood-based materials that is effective against mold and decay fungi and also prevents termite infestation. Because it is non-toxic, nonvolatile, odorless and hypoallergenic, it is suitable for indoor use. Field tests for outdoor applications are in progress. This technology transfer outcome was achieved through patents available for licensing.

Technology for Measuring Duff Moisture Content Improves Safety of Forest Fires



FS inventors developed a machine to quickly assess moisture content in the duff, or the surface of the forest floor. Their invention is a portable unit that can be carried to the forest and test the moisture of forest duff using electrical calculations and surface probes. This way, people in charge of containing a fire can determine in a few minutes, rather than days, the moisture levels in the duff and thereby provide better control of fires. This technology was licensed to a private sector partner.

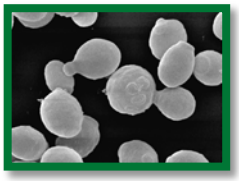
Rotary Water Pump Eases Use for the Disabled

This patented rotary hand pump requires less force than traditional pumps to draw water from underground wells. The force needed to operate the pump is about one-third less than the force required to operate a traditional lever-operated pump due to its counterbalance design. This feature, in addition to its accessible height, make the pump ideal for installation at public parks and other recreational facilities to increase disabled persons ease of access to potable water. This technology transfer outcome was achieved through patents available for licensing.

Non-Destructive Evaluation of Trees

Forest Products Laboratory researchers developed an instrument that uses acoustic, laser, ultrasound, and wireless technologies to evaluate the strength and soundness of the wood in standing trees. This technology allows forest managers to determine the quality of wood without cutting down the tree, which results in more efficient timber harvesting and better monitoring of forest health. This patent has been licensed by joint-owner University of Minnesota to a private sector partner.

Ethanol Fermentation and Related Technologies



The Forest Products Laboratory, in conjunction with the University of Wisconsin-Madison, have developed a number of patented technologies related to ethanol fermentation and related processes, such as the fermentation of xylose to ethanol, color removal from wood pulps, yeast transformation systems, and the production of xylitol. This technology transfer outcome was achieved through licensing by the university to a private sector partner.

Improved Biofuel Production from Woody Biomass

A major barrier to the commercial development of biobased fuels and products from woody biomass has been addressed with the development of a novel process by Forest Service and University of Wisconsin-Madison scientists. The process, a sulfite pretreatment to overcome recalcitrance of lignocelluloses or SPORL, helps overcome the natural resistance of biomass to enzymatic deconstruction, a necessary step in biofuels production. SPORL can efficiently convert softwoods, which are most recalcitrant but can be sustainably produced in several parts of the world. Additional benefits of the process include significant reduction in the energy needed to reduce the size of woody biomass, which is critical to bioenergy production; excellent commercial scalability, as it makes use of existing equipment, processes, and knowledge of the pulp and paper industry; fewer technical barriers to building new plants or to retrofitting existing pulp mills to production of biofuels; and excellent potential for co-production of value-added lignin products. Patents are currently pending on this technology.

DOWNSTREAM OUTCOMES FROM APHIS NATIONAL WILDLIFE RESEARCH CENTER (NWRC) TECHNOLOGY TRANSFER ACTIVITIES

Immunocontraceptive Vaccine for Wildlife (2010 Governor's Award for High Impact Research Colorado Federal Research Labs)

Deer populations have increased from only about 500,000 deer across the United States in the early 1900's to over 15 million today. Although this recovery is considered a wildlife management success story, deer are causing many problems, particularly in urban environments. Ornamental trees and shrubs in residential and commercial areas suffer damage as deer seek alternative food sources. High populations of deer result in numerous deer/vehicle collisions and pose a serious threat to motorists. It is estimated that there are over 700,000 deer-vehicle collisions each year that result in more than 200 human fatalities and 29,000 injuries. In addition to vehicle accidents, deer have been implicated in the distribution and transmission of Lyme disease.

Over the past 14 years, scientists from the NWRC have worked to develop a new wildlife immunocontraceptive (GonaCon™) to help reduce overabundant urban white-tailed deer and other overabundant wildlife populations. GonaCon is a vaccine that causes deer to remain infertile for up to 5 years following a single injection. This multiyear single-shot vaccine stimulates the production of antibodies that bind to gonadotropin-releasing hormone (GnRH)—a hormone necessary for production of estrogen, progesterone, and testosterone. By binding to GnRH, the antibodies reduce GnRH's ability to stimulate the release of these sex hormones. As long as a sufficient level of antibody activity is present in the bloodstream, sexual activity is decreased, and vaccinated animals remain infertile. In September 2009 Wildlife Service's NWRC obtained a registration for GonaCon with the U.S. Environmental Protection Agency (EPA) for use with female white-tailed deer 1 year of age or older. NWRC anticipates its use primarily in urban/suburban areas where other management tools cannot be used. Vaccinated animals show a decrease in sexual activity and breeding behavior. There is no known danger associated to humans or wildlife from eating deer that have been vaccinated with GonaCon. In addition to deer, GonaCon has proven effective for use with numerous other wildlife species, including California ground squirrels, prairie dogs, Norway rats, feral cats and dogs, wild horses, elk, and bison. Future research will be directed toward registering GonaCon for use with other wildlife species and for prevention of wildlife disease transmission.

Development of a Woodpecker Deterrent

Researchers from the U.S. Department of Agriculture's National Wildlife Research Center (NWRC) and Colorado State University have shown that addition of a polyurea elastomer coating to utility pole crossarms reduced damage by captive pileated woodpeckers (*Dryocopus pileatus*). These findings could save the utility industry several hundred thousand dollars annually by aiding in the development of woodpecker deterrents that reduce the number of visits and costs for wooden utility pole maintenance. In captive studies at the NWRC, researchers evaluated the effectiveness of the polyurea elastomer coating applied to crossarms in a process developed by Brooks Manufacturing Company (Bellingham, Wash.). Research has shown fully coated crossarms received no measurable damage however woodpeckers removed an average of 29.5 g of wood chips from uncoated crossarms. The cost of an uncoated wood crossarm is approximately $22-35 USD and a fiberglass composite crossarm is approximately $65-120 USD. A coating of the polyurea elastomer product (1.78-mm thick) for a standard 9.5-by-12.0-cm crossarm that is 2.4 m long costs approximately $30-45 USD. Thus, the cost of wood crossarms with protective polyurea elastomer should remain less or comparable to crossarms of other materials on the market. This technology transfer outcome was achieved through public release of information.

Learning How Birds Perceive Aircraft

Two-thirds of bird strikes resulting in serious aircraft damage occur between zero and 500 feet above ground level. However, a substantial number of strikes also occur between 501 and 3,500 above ground level. At that height, certain ground-level dispersal methods, like loud noises or bird-chasing dogs, are ineffective. National Wildlife Research Center researchers in Sandusky, Ohio, and their collaborators from Indiana State University, Purdue University, Precise Flight, Premises Control, and the Federal Aviation Administration (FAA) are learning more about how birds detect and respond to approaching aircraft. Specifically, researchers are investigating how birds detect and respond to object approach (such as aircraft), and whether changes to wavelengths and pulse frequencies of aircraft lighting can make aircraft more visible to birds. Vision is a primary sensory pathway in birds. While birds, like humans, see in color, they have different photoreceptors and can see beyond the range humans can. Research was conducted with captive Canada geese using a 10-ft wingspan, remote-controlled plane outfitted with the Precise Flight lighting system with geese with clipped wings were placed in a 56-foot diameter enclosure, surrounded by high-speed video cameras to capture the birds' response to the approaching plane. The plane made multiple approaches to each set of birds, some with the lights on and some with them off. Researchers are evaluating the video footage frame by frame to see if the lights improved the birds' detection and avoidance of the plane. In addition, via the Purdue laboratory, the researchers are quantifying the visual capabilities of Canada geese, particularly their sensitivity to color, contrast of the aircraft to surrounding light conditions, movement, and their ability to clearly resolve an approaching object at distance. The behavioral and physiological findings are promising and researchers are optimistic their efforts will result in new methods to help birds detect and avoid aircraft in the air. This will add another tool in the wildlife hazard mitigation toolbox and complement existing wildlife management on airports. This technology transfer outcome was achieved through public release of information.

Enhancing Deer Awareness to Approaching Vehicles

Each year, deer-vehicle collisions (DVCs) are responsible for greater than $1.1 billion in damages, injuries, and loss of animals in the United States. There are many factors that contribute to the number of DVCs in an area, including deer population demographics, traffic volume and speed, activity patterns, seasonality, and habitat features. Many of these factors are unchangeable, but the ability to develop lighting systems in vehicles to enhance deer avoidance may be one factor that could be improved. To help reduce DVCs, NWRC researchers tested how the spectrum from two currently available automobile lighting systems might serve to alert deer to approaching vehicles. Currently, most cars are equipped with standard tungsten-halogen (TH) headlights. However, these types of lights may not provide the best complement to deer visual capabilities at night. The researchers assumed that deer do not necessarily discern the vehicle or associate vehicle lighting with the fact that something much larger than the light (the vehicle) is approaching. They also assumed that under low-light conditions and, possibly, after complete darkness, deer would have limited sensitivity to colors in the blue range of the spectrum. By exploiting this sensory capability, it could be possible to enhance deer detection and avoidance of vehicles. Research results show that the combination of TH lamps and constant illumination of High Intensity Discharge (HID) lamps increased the distance at which white-tail deer reacted to approaching vehicles, on average by as much as 20 meters. Products, such as new vehicle lighting systems, created as a result of this research could potentially lower the number of DVCs occurring in the U.S. and abroad. This technology transfer outcome was achieved through public release of information.

New Air Cannon Net Launcher Eliminates Need for Explosives

Wildlife Services employees Dan McMurtry (WS Missouri) and John Cummings (WS National Wildlife Research Center) have partnered with Martin Engineering, a private company, to design and develop a new air cannon net system for capturing wild birds. The new design eliminates the need for explosives and, instead, relies upon compressed air to launch four 5-pound projectiles attached to a 40 x 60 foot net.

In field evaluations, the new air cannon net system was effective at capturing over 90% of California gulls and red-winged blackbirds that were within 12-18 feet of the air cannon. Research noted “the air cannon net system is capable of deploying various net sizes by adjusting the air pressure and shoots a typical 40 x 60 ft net further and faster than the current cannon net systems, but it doesn't require knowledge of explosives, knowledge, training or transport. The system is very mobile and easy to handle for one person.” The WS Management Team sees the air cannon net system as a potentially useful tool for avian influenza disease surveillance or any other bird collections. Currently this product is sold as the “Net Blaster” and can be purchased through Wildlife Control Supplies http://www.wcsnetblaster.com/WCScustomers.html.

DOWNSTREAM OUTCOMES FROM ARS & THE BUREAU OF RECLAMATION TECHNOLOGY TRANSFER ACTIVITIES

The U. S. Department of Agriculture-Agricultural Research Service (ARS) and the U.S. Department of the Interior-Bureau of Reclamation (Reclamation) share similar research missions for providing water management solutions for irrigated agriculture. In 2007, ARS and Reclamation entered into an interagency agreement where ARS provides extensive technology transfer services to help Reclamation effectively implement federal technology transfer legislation. This agreement has led to many productive research and technology transfer agreements between Reclamation, industry representatives, and other non-federal organizations. Reclamation's internal technology transfer capability has also been significantly increased through the close, collaborative hands-on working relationships between ARS and Reclamation that was designed into the interagency agreement.

Since 2007, this interagency agreement has also improved the coordination and conduct of collaborative research between these two agencies which has served to avoid duplication of research efforts, better leverage resources, and increase efficiency, value and impact for our common stakeholder interests. One such effort is jointly exploring potential alternatives to polyacrylamide (PAM) for reducing canal seepage.

Seepage through unlined canals is a significant water delivery system loss on a national and international basis. Safe, effective, low cost methods to reduce these losses are highly sought. PAM is currently being used by some owners and operators of unlined water delivery canals to reduce seepage-based water losses. PAM flocculates sediment entrained in canal waters causing sediment-laiden flocs to settle to the bottom of the canal and fill small voids in the canal substrate that are pathways for seepage. This sediment settling process occurs naturally over the length of an irrigation season and can gradually reduce seepage losses depending on canal-specific conditions. The addition of a flocculent accelerates and optimizes this process resulting in the potential to significantly reduce seepage losses over an irrigation season.

Reclamation sponsored studies, in coordination with EPA and ARS, to evaluate PAM's seepage reduction effectiveness and associated risks to human health and the environment. In some settings, the studies indicate that the flocculating action of PAM can reduce seepage by as much as 90 percent. However, PAM also contains small amounts of acrylamide which is a neurotoxin, genotoxin, and possible carcinogen. If PAM applications for canal sealing purposes could be properly controlled and managed, these associated risks to human health and the environment would likely be low.

However, ensuring applications are properly controlled and managed is difficult because there is an absence of clear regulatory protocols for adding chemicals to canal waters for the purpose of reducing canal seepage. In addition, although PAM has many commercial applications as a chemical flocculent, it is not labeled for reducing seepage from canals. Realizing that PAM or other chemical additives would occur over thousands of miles of canals in various, open environment conditions adds to the difficulty. As such, Reclamation issued a decision to not allow the use of PAM in Reclamation-owned water delivery canals in the absence of clear regulatory protocols.

Reclamation and ARS are now working together to pursue the development of safe, alternative products, and working with EPA to establish appropriate regulatory protocols for PAM and/or alternative products for this specific application. In 2008, Reclamation and ARS organized and sponsored a workshop in February 2008 to further explore potential alternatives and concerns associated with the use of PAM. The proceedings from this workshop can be viewed at:
http://www.usbr.gov/research/science-and-tech/research/results/PAM/2008%20PAM%20Workshop.pdf
Both agencies are now forming industry research partnerships to develop safe, effective chemical or biodegradable products specifically designed to reduce canal seepage.

IMPACT FIELD DAYS CONDUCTED AT ARS LOCATIONS IN FY 2010

Maryland:

On June 5, 2010, the Henry A. Wallace Beltsville Agricultural Research Center (BARC) celebrated its 100th anniversary with a public field day to commemorate past research successes, celebrate current research efforts, and anticipate future endeavors. There were over 50 exhibits of past and present research accomplishment s. This celebration was not just for BARC alone; it was a celebration for all of the Agricultural Research Service (ARS). The USDA was established in 1862 on the National Mall in Washington, DC. As the mission and research program expanded, additional land and facilities in the surrounding Washington, Maryland, and Virginia area were leased. During the late 1930's, all the research facilities in Maryland, Virginia and Washington were co-located at the "National Agricultural Research Center" in Beltsville, MD. Much of the research currently being conducted by ARS labs around the country originated at BARC. For example, Daniel E. Salmon and his assistants were the first to isolate and discover *Salmonella* bacteria in pigs. In 1910, they were asked to continue their *Salmonella* research with USDA at the newly formed BARC. Now, a century later, ARS labs in Albany, California; Ames, Iowa; Athens, Georgia; Clay Center, Nebraska; College Station, Texas;

and Wyndmoor, Pennsylvania, have joined BARC in continuing the research started by Salmon to help USDA remain a leader in *Salmonella* research. (http://www.ars.usda.gov/Aboutus/docs.htm?docid=19863).

Minnesota:

The North Central Soil Conservation Research (NCSC) lab in Morris conducts regular annual field day and participates in other activities, especially those conducted by collaborators and the local community.

NCSC conducted its annual field day (August 19, 2010) with "Renew Flower Power" as the theme chosen by the Lab's stakeholder group in reference to research being conducted by scientists on oilseed crops. Several on-station and on-farm presentations and activities were carried out during the field day in collaboration with farmers and collaborators from the private sector. The audience came from the local farming community and the private industry. Attendees learned about new research and technologies for domestic energy production and replacements for imported materials, including tropical oils.

NCSC participated in the Stevens County Fair (August 11-14, 2010) as a part of its strategy to inform and educate the local community about our mission and research program. The theme for our participation was in line with and in preparation for the field day. Attendees from the local and surrounding communities had the opportunity to observe some of the new and alternative crops as sources for alternative energy. Also, we distributed invitations to the field day that followed.

Also, NCSC participated in a "Community Connection Expo" (February 25, 2010) to promote the lab as a part of the local community, and to highlight the impact of our research program at the local and national levels.

Iowa:

National Laboratory for Agriculture and the Environment
Sustainability of Agricultural Production Systems

Ames, Iowa—July 15, 2010 - This field day was held to showcase research being conducted to evaluate sustainability in corn and soybean production systems. The field day consisted of tours of research plots and presentations on measurement techniques for sustainability research.

USDA-ARS Breeding Corn for Sustainable AG and The U.S Testing Network

Ames, Iowa – Topic - Linda Pollak's (USDA-ARS CICGRU) research and the research of the Michael fields Agriculture Institute (Walter Goldstein, East Troy, WI) and The Practical Farmers of Iowa (Sarah Carlson, Iowa State University). ARS set up demo plots so participants could view corn breeding lines. Dr. Tom Sappington (USDA-ARS CICGRU) spoke about European corn borer, the rootworm complex, black cutworms, outlook on insects affecting corn production, and native resistance. Sarah Carlson discussed the purpose and goals of the United States Testing Network (USTN). Despite cold, wet weather 70-80 people attended representing breeders, small seed companies, and producers.

R. G. Palmer USDA ARS Soybean Genetics Project

Agronomy Soybean Research Field Day - hosted by Iowa State University. Reid Palmer (USDA-ARS CICGRU) spent three hours with international and US graduate students in plant breeding discussing the following research projects: 1) Soybean genome fluidity; increases with plant stress, 2) Soybean insect-pollinator activity and hybrid soybean, and 3) Soybean transposons and generation of useful variants.

Colorado:

Field Day at the ARS Limited Irrigation Research Farm Aug 16, 2010

Field day was held in conjunction with the Weld County Chamber of Commerce Ag Tour and the field day of ARS CRADA partner. The CRADA partner demonstrated farm irrigation infrastructure, instrumentation, and crop field plots; had poster displays, CRADA partner provided lunch for the attendees. Approximately 200 attendees including growers, local government, state agencies, federal agencies, university, ARS, water engineers and lawyers.

Akron, CO field days

ARS had 4 field day events this past year. The largest is the spring field day in held June 16th, 2010. The event was attended by visitors from the four states of Colorado, Nebraska, Kansas and Wyoming. There were 170 in total attendance. The findings are directed toward providing the public useful information as might be related to their farming and ranch operations. In addition to the presentation a field day "book" was distributed to all attendees. The field day book contained a write-up based on the presentation as an additional tech transfer medium. The field days tend to be tailored to specific visitors, (Australian farmers, Wheat farmers, Sorghum farmers etc). The public is encouraged to ask questions and to interact on a personal level with the science staff and the day does provide a good exchange between the ARS- science staff and the farmers who use the station as a resource for ideas and management technology of the cropping systems and soil of the Central Great Plains Region.

North Dakota:

USDA Friends & Neighbors Day at Mandan

Friends & Neighbors Day at the USDA-ARS Northern Great Plains Research Laboratory has grown into a major community activity. From a small event drawing 100-200 producers eight years ago, on July 23, 2010 it was attended by over 1000 family farmers and ranchers, agribusiness, community leaders, and the public from throughout the region. In addition to the public tech transfer activities, ARS scientists met with the Lab's Customer Focus Group; 40-50 innovative customers who biennially gather to interact with leadership and staff to provide input on needed research for the northern Great Plains region. The event featured a major tour of natural resources research and tech transfer presentations by USDA-ARS scientists. Innovative family farmers and ranchers from around the region time and again adopt new practices they observe to be effective even before final scientific review and reporting is complete. The scientific and technical staff answered questions on USDA-ARS research one-on-one (and in groups) with agricultural innovators all afternoon. The region's

eleven largest farm organizations and commodity groups now join over 70 commercial sponsors in support of this annual activity and promote attending to their membership for new innovative production ideas and sustainable practices.

Idaho:

- Boise Field Tour of ARS watershed for the AGU Chapman Conference: 85 national and international scientists in October 2009 (1 day).
- Hydrology camp: 20 Owyhee high school students at our watershed in April 2010 (Boise, 2 days).
- EBIPM Field School: for 100 natural resource scientists and students (joint program along with ARS Burns) held in Boise in September 2010 (2 days).
- Dr. Hardegree hosted an EBIPM field tour out at Skate Park to demonstrate our research and plot demonstration program on December 1, 2009 that was open to everyone and was attended by about 20 people from different federal, state and county agencies.
- Dr. Hardegree hosted a field tour in Boise for University of Idaho students on April 29th 2010 that had 30 people out at Skate Park to demonstrate our research and demonstration program as part of EBIPM.

Idaho Grape Days

- "USDA-ARS-HCRU Food Chemistry laboratory recent projects and tour", Parma, ID, August 2010.
- Food Chemistry lab "USDA-ARS-HCRU Multistate research project-Virus and virus-like diseases of fruit trees, small fruits, and grapevines). Parma, ID, September 2010.
- National Clonal Germplasm Repository: ARS hosted three field days in 2010, in addition to a number of field tours, fruit tastings, industry visits and outreach presentations to various classes and groups including Oregon State University (several classes), Willamette University (two classes), Linn-Benton Community College (Plant Propagation, February), Philomath High School (Botany Classes, September), Eugene Plant Propagation Fair (March), Home Orchard Society Scion Exchange (March) and Fruit Show (October), Eugene Slow Food Pear Tasting (September)
- Friday April 23, 2010 - Tree peony open house
- Friday June 11, 2010 - Herbaceous peony open house
- Saturday July 17, 2010 - Blueberry collection open house in conjunction with OSU Lewis Brown Farm field day and Corvallis DaVinci Days.

Oregon:

The Pendleton ARS and the OSU Experiment Station are co-located at Pendleton and hold a joint Field Days in June each year. This year's Field Day was held on June 15, 2010; had approximately 160 people attend.

The Craneberry, blueberry, and strawberry field days are hosted at OSU every summer. These are well attended field days organized by OSU that can have a worldwide draw in the case of blueberry. ARS hosted a meeting of collaborators from the US and Australia to coordinate research on the genomics of biological control strains of Pseudomonas.

California:

The Shafter Cotton Field Day was held at the Shafter Cotton Research Station, Shafter, CA, on September 14, 2010. The field day featured research presentations on cotton agronomy, genetics, pathology, and entomology by ARS scientists and University of California collaborators. The field day was attended by 57 people representing ag-chemical and cotton industries, cooperative extension service, Kern County, and local producers.

The 6th Annual International Table Grape Symposium hosted a field day in July 2010 at the Parlier location as a part of its overall program, and there were four field days, August, September, October and December 2010 with the California Table Grape Commission Research Committee hosted by the location's grape program.

Washington:

Land Management and Water Conservation Research Unit-A field day on June 24th, 2010, Pullman.
Grain Legume Genetics Research Unit- Twilight Tour at Spillman Farm July 15th, 2010, Pullman.

Texas:

Texas Pecan Management Short course Jan 28, 2010

The Texas Pecan Management Short course is designed by Texas AgriLife Extension to be an annual, intensive training program for new orchard managers. Visitors spend time in the equipment compound, checking out the sprayers, tree lifts, trunk shakers, roll-out harvesters, and the nut cleaning, drying and shelling facilities that support ARS research work. Many managers take advantage of the Soil Survey Reports library to find their property, study the soil descriptions and discuss site limitations and management options. Some are interested in the Nut Library, a collection of nut vouchers we maintain of named pecan cultivars, as well as other species of the genus *Carya*.

Wheat Field Day at the Texas AgriLife Research & Extension Service North Plains Research Field in Etter, Texas.

On May 19, 2010, employees of the Conservation and Production Research Laboratory, Bush land, Texas, participated in the Wheat Field Day at the Texas AgriLife Research and Extension Service North Plains Research Field in Etter, Texas. The field day was also sponsored by USDA-ARS, West Texas A&M University (WTAMU), Texas Wheat Producers Board, and the North Plains Groundwater Conservation District. This field day focused mainly on wheat production as forage for livestock grazing and as a food/feed. The impact was the information shared with producers and commodity personnel on advances in wheat research on water conservation, breeding and genetic advances, wheat management, and insect management and control for wheat production in this important region.

Summer Crops Field Day with the Texas AgriLife Research and Extension Service of Amarillo.

Over 125 producers, farmers, extension specialists, university collaborators, and staff attended this field day. This field day focused on sorghum primarily. It provided current research information to producers as well as action agencies (Extension County Agents, USDA-NRCS specialists) and crop commodity personnel. The impact will be through a better understanding for sorghum production as a grain (feed and food) crop, a forage crop, and as an energy crop (ethanol both grain and cellulosic).

Calera Workshop

The ARS Conservation and Production Research Laboratory, Bushland, Texas, along with the ARS Grazinglands Research Laboratory, El Reno, Texas, hosted a research workshop from July 7-9, 2010, on "Sustainable Water Management" that focused on international collaboration with Mexico on the Calera Aquifer entitled "Enhancing Groundwater Sustainability Under Increased Climate Deficits: Policy and Management Alternatives with a Focus on the Calera Aquifer in Zacatecas, Mexico." This ongoing national and international effort strengthens the ARS efforts on water conservation and groundwater policy for sustainability. It provides an opportunity for ARS at El Reno and Bushland to work together on surface and groundwater modeling using SWAT and MODFLOW models coupled to model the Ogallala Aquifer in the U.S. and the Calera Aquifer in Zacatecas, Mexico. This research impacts the sustainability of both regions as well as the impact on local economies through increased agricultural productivity and decreased aquifer water depletion.

Plant Diagnostic Network, Oct. 19, 2010

The Pecan Breeding and Genetics unit hosted a field trip of the joint meeting of the Southern Plains Diagnostic Network (SPDN) and the Great Plains Diagnostic Network (GPDN). The SPDN is a consortium including Florida (regional center and hub lab), Arkansas, Alabama, South Carolina, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Puerto Rico, Tennessee, Texas, Virgin Islands, and Virginia. The Great Plains Diagnostic Network (GPDN) is a consortium of nine states including Montana, North Dakota, South Dakota, Wyoming, Nebraska, Colorado, Kansas, Oklahoma, and Texas. Both groups represent regions of the National Plant Diagnostic Network. The mission of the National Plant Diagnostics Network includes coordinated diagnostics, secure communications, and training of first detectors of important plant disease and insect problems.

Oklahoma:

The Wes Watkins Agricultural Research Laboratory

The Wes Watkins Agricultural Research Laboratory, Lane, OK, hosts two scheduled field days. The first is a general audience field day which is open to the public and is designed to incorporate the science done at the location with other activities. The object is to provide information to producers, allow children to recognize that science is interesting, and provide a time and place for stakeholders and co-operators to interact with each other and members of the community. In 2010 this field day drew a little over 1000 persons. The other scheduled field day is for producers interested in organic production. The activities are more of a technical

nature and aimed at the science and methods of organic production. In 2010 about 100 persons attended. During the year we host specialized programs for schools and teacher organizations or varying sizes all with the objective of disseminating information about the science and technology of agriculture.

Hard Winter Wheat Breeders' Field Day – 2010

"Established in 1931, the Hard Winter Wheat Regional Nursery Program is coordinated by the USDA-ARS for the benefit of the hard winter wheat growing region and its numerous federal, state, and private breeders and breeding programs. The regional nursery program was established to foster testing of advanced breeding lines in diverse environments, to characterize disease response and quality characteristics of wheat cultivars before they are released for production, to facilitate free exchange of germplasm, and to allow the evaluation of potential new cultivars by states lacking wheat breeding programs. The nursery program includes the Southern Regional Performance Nursery (SRPN), the Northern Regional Performance Nursery (NRPN) and the Regional Germplasm Observation Nursery (RGON). The SRPN and NRPN are replicated yield trials and limited to 50 entries per year. The SRPN is grown at 30+ locations, with sites in New Mexico, Texas, Oklahoma, Kansas, Colorado, Nebraska, South Dakota, Missouri, Iowa, Wyoming, Idaho and Oregon. The NRPN is grown at 15+ locations, situated in Nebraska, Minnesota, South Dakota, North Dakota, Wyoming, Idaho, and Alberta, Canada.

Each year, the Regional Coordinator summarizes the results of the various nursery trials in report form, which is then distributed to wheat breeders and other interested parties within the growing region. Region-wide and statewide means are provided, and environmental stability is analyzed. The USDA-ARS Hard Winter Wheat Quality Lab produces a separate report, summarizing end-use quality traits, that is also distributed to regional wheat breeders on an annual basis. The impact is an opportunity to further assess disease response and quality characteristics of wheat cultivars before they are released, breeders within the region, along with USDA personnel, hold a field day at a different field location within the region on an annual basis. The 2010 Field Day was held in Lahoma, OK, May 10-11.

South Carolina:

Nov 16, 2010 - 12th Annual Customer/Partner Dialogue Workshop at the Coastal Plain Soil, Water and Plant Research Center in Florence, SC on Nov 16 2010.

Sept 8-9, 2010 - Research Liaison Group Meeting in Clemson, SC

April 6-9, 2010 - Miami Dedication and talk with stakeholders

May 5-7, 2010 - Ft Pierce Liaison Meeting

August 3-6, 2010 - Bionergy and Field Day at Tifton, GA

Mississippi:

Cotton Extension for ARS is involved in organizing three Ginners School in coordination with the National Cotton Ginners Association. Each of the schools are conducted at the USDA, ARS gin labs in Lubbock, Texas, Mesilla Park, New Mexico, and Stoneville, Mississippi. Each 3-day school trains gin managers and operators on basic principles of gin equipment function and operation for improved efficiency and profitability. Advanced sessions are provided on new technology and cotton industry issues. Gin Schools allow researchers opportunity to interact with customers and stakeholders and provides an excellent forum to update clientele on current research activities and accomplishments. In 2010, 270 participated in the events, along with 24 instructors from ARS, Universities, Industry, and Cotton organizations.

Cotton Extension organizes an annual Cotton Ginning or Textile Symposium, which is attended by Extension Agents and Cotton Specialist from across the cotton belt states. This 2-day program provides a basic understanding of the ginning and textile processing and helps advisors understand the importance of variety selection, defoliation and harvesting operation on fiber processing. This year's Cotton Ginning Symposium was held at the Cotton Ginning Research Unit in Stoneville, Mississippi. The event featured and 14 speakers and was attended by 22 participants.

Cotton Extension is the co-chair of the Cotton Ginning Technical Conference at the Beltwide Cotton Conference. This 1.5-day session includes technical presentations that were presented by University and ARS researchers and gin equipment manufactures. Proceedings from these presentations are reviewed and edited for publication.

Cotton Extension organizes a Technical Committee on Cotton Quality (TCCQ), which was held at the Cotton Quality Research Station, in Clemson, South Carolina. This group represents a wide array of industry, government, and Cotton association involvement into the review and discussion of research needs and priorities. This meeting was attended by 34 ARS Researchers, cotton and textile equipment manufacturers, cotton merchants, and industry representatives from National Cotton Council, Cotton Incorporated, and AMS.

2010 ARS GERMPLASM RELEASES AND DISTRIBUTION

Site	UARS	UFED	STA	UCOM	UPRU	UIND	UAID	INT	FGEN	FCOM	FPRU	FIND	Total	%
BRW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COR	1362	0	11	0	0	24	0	0	0	0	0	0	1397	0.8
COT	741	0	551	199	2	102	0	0	505	0	60	4	2164	1.3
DAV	342	1	288	843	246	2347	0	0	160	36	18	17	4298	2.5
FLAX	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GEN	1270	1	582	642	153	2268	0	0	0	6	126	20	5068	2.9
GSOR	105	0	5857	61	4	9	0	0	217	43	315	0	6611	3.8
GSPI	0	0	32	1	0	0	0	0	0	0	9	0	42	0
GSZE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HILO	0	0	7	2	1	12	0	0	16	0	0	0	38	0
MAY	37	17	80	24	19	102	0	0	0	0	1	1	281	0.2
MIA	214	2	119	59	19	13	0	0	0	14	2	0	442	0.3
NA	2	0	0	0	0	3	0	0	0	0	0	0	5	0
NC7	2583	32	7298	6506	448	1157	0	53	792	2092	3609	38	24608	14
NE9	385	0	1307	937	97	732	0	0	223	635	380	29	4725	2.7
NR6	667	0	1566	839	38	555	0	0	9	45	480	6	4205	2.4
NSGC	14255	3	14865	4340	161	1126	0	28	3681	1403	10353	58	50273	29
NSSL	4	0	15	17	1	12	0	0	144	8	1	0	202	0.1
NTSL	0	2	0	0	0	0	0	0	0	0	0	0	2	0
OPGC	10	0	174	123	25	31	0	0	0	25	6	0	394	0.2
PALM	153	0	30	443	54	115	0	0	0	0	52	26	873	0.5
PARL	55	0	72	106	86	50	0	0	135	53	153	0	710	0.4
RIV	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S9	4173	17	7306	5993	139	996	0	0	907	5092	959	98	25680	15
SOY	3439	0	5480	4486	5	286	0	0	5188	158	1939	1	20982	12
TGRC	0	0	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	0	0
W6	3221	18	5507	2268	146	946	0	6	347	1995	5225	82	19761	11
Total	33018	93	51147	27889	1644	10886	0	87	12324	11605	23688	380		100
%	19.1	0.1	29.6	16.1	1	6.3	0	0.1	7.1	6.7	13.7	0.2	100	

The National Genetic Resources Program (NGRP) is responsible for acquiring, characterizing, preserving, documenting and distributing to scientist, germplasm of all life forms important for food and agricultural Production. With NGRP, the Germplasm Resources Information Network (GRIN) provides information about plants, animals, microbes and invertebrates. In 2010, GRIN distributed from 27 repositories over 172,000 accessions throughout the world.

ARS GERMPLASM RELEASES AND DISTRIBUTION (KEY)

CATEGORIES: **FCOM**=Foreign commercial company, **FGEN**=Foreign genebank/resources unit, **FIND**=Foreign individual no affiliation, **FPRU**=Foreign non-commercial organization, **INT**=CGIAR International Agr. Res. Center, **STA**=U.S. state agencies and all universities, **UAID**=US agency for International Development, **UARS**=Agricultural Research Service, **UCOM**=U.S. commercial company, **UFED**=U.S. Federal agency (not ARS or AID), **UNID**=U.S. individual no affiliation, **UPRU**=U.S. non-profit organization, **SITE**=ARS repository location, **Distribution of germplasm (See World Map – next page)**

Repository Key:

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
W6	Western Regional PI Station

DISTRIBUTION MAP OF 2010 ARS GERMPLASM RELEASES

Addendum 1

ARS TECHNOLOGY TRANSFER AWARD WINNERS

2010 ARS Technology Transfer Awards

Scientists: Dr. Chris M. Maragos, Bacterial Foodborne Pathogens and Mycology Research Unit, Peoria, Illinois
Title: Development of Essential Antibodies
Citation: For the development of antibodies essential to the manufacture of improved toxin detection assays
Award: ARS Outstanding Award

Scientists: Dr. Charles R. Brown et al, Vegetable and Forage Crop Research Unit, Prosser, Washington
Title: Pacific West Area Potato Breeding Program
Citation: For the development and transfer of new potato varieties in the Pacific Northwest
Award: ARS Outstanding Award

Scientists: Dr. Xiaoliang Cui, Southern Regional Research Center, New Orleans, Louisiana
Title: Cotton Classification
Citation: For outstanding efforts in supporting the transfer of the USDA, AMS process for cotton classification, which helped to facilitate the sale of U.S. cotton in China
Award: ARS Superior Award

Scientists: Dr. C. Corley Holbrook, Crop Genetics and Breeding Research Unit, Tifton, Georgia
Title: Development of Tifguard
Citation: For development and transfer of Tifguard, the first high yielding peanut cultivar with resistance to both the peanut root-knot nematode and Tomato Spotted Wilt Virus
Award: ARS Superior Award

Scientists: Dr. David L. Suarez et al, Exotic and Emerging Avian Viral Diseases Research Unit, Athens, Georgia
Title: H1N1 Pandemic Influenza Veterinary Team
Citation: For rapid response to H1N1 pandemic influenza by timely development and transfer of diagnostic tests for veterinary specimens
Award: ARS Superior Award

Scientists: Dr. W. Clint Hoffmann et al, Areawide Pest Management Research Unit, College Station, Texas
Title: Aerial Application Technology Team
Citation: For effective transfer of spray application technology to the Florida citrus industry for enhanced control of citrus greening disease
Award: ARS Superior Award

Scientists: Dr. Vijay Juneja et al, Residue Chemistry and Predictive Microbiology Unit, Wyndmoor, Pennsylvania
Title: Predictive Microbiology
Citation: For developing, implementing, and expanding the USDA Pathogen Modeling Program, Predictive Microbiology Information Portal (PMIP) to enhance food safety of the Nation's food supplies
Award: ARS Superior Award

Scientists: Dr**.** Kevin B. Hicks et al, Sustainable Biofuels and Co-Products Research Unit, Wyndmoor, Pennsylvania

Title: Winter Barley Team
Citation: For developing and transferring technology enabling the Mid Atlantic winter barley ethanol industry that is benefiting energy independence, the environment, and the rural economy in the U.S.A
Award: ARS Superior Award

Scientists: Dr. Kamal Chauhan et al, Beltsville, Maryland
Title: Invasive Insect and Biocontrol and Behavior Laboratory
Citation: For the development of a new "Super Lure" to safely control important insect pests in home gardens and organic farms
Award: Beltsville Area Paul Doraiswamy Technology Transfer Award, Beltsville, Maryland

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2010 Federal Laboratories Consortium (FLC) Awards

Scientist: Dr. Philip Klesius et al, Aquatic Animal Health Research Laboratory, Auburn, Alabama
Title: Novel Fish Vaccines
Citation: For novel fish vaccines to prevent severe economic losses in aquaculture
Award: National Excellence in Technology Transfer

Scientist: Dr. Peter Follett et al, Tropical Crop and Commodity Protection Research, Hilo, Hawaii
Title: Implementation of Phytosanitary Irradiation
Citation: For implementation of phytosanitary irradiation treatment protocols for tropical fruit
Award: National Excellence in Technology Transfer

Scientist: Dr. Matias Vanotti et al, Coastal Plain Soil, Water and Plant Conservation Research, Florence, South Carolina
Title: Livestock Manure
Citation: For second generation treatment system for management of livestock manure
Award: National Excellence in Technology Transfer

Scientist: Dr. Anna McClung, Dale Bumper National Rice Research Center, Stuttgart, Arkansas
Title: New Rice Varieties
Citation: For rice varieties for the processed, specialty, and organic rice industry
Award: National Excellence in Technology Transfer

Scientist: Dr. James Mahan et al, Plant Stress and Germplasm Development Research, Lubbock, Texas
Title: BIOTIC
Citation: For development and transfer of BIOTIC irrigation control technology
Award: National Excellence in Technology Transfer

Scientists: Dr. Vijay Juneja et al, Residue Chemistry and Predictive Microbiology Unit, Wyndmoor, Pennsylvania
Title: Predictive Microbiology
Citation: For developing, implementing, and expanding the USDA Pathogen Modeling Program, Predictive Microbiology Information Portal (PMIP) to enhance food safety of the Nation's food supplies
Award: Mid-Atlantic Region Excellence in Technology Transfer

Scientists: Dr**.** Kevin B. Hicks et al, Sustainable Biofuels and Co-Products Research Unit, Wyndmoor, Pennsylvania
Title: Winter Barley Team
Citation: For developing and transferring technology enabling the Mid Atlantic winter barley ethanol industry that is

benefiting energy independence, the environment, and the rural economy in the U.S.A
Award: Mid-Atlantic Region Excellence in Technology Transfer

Scientists: Dr**.** David Geveke et al, Food Safety and Intervention Technologies Unit, Wyndmoor, Pennsylvania
Title: Flash Pasteurization
Citation: For flash pasteurization for improving the food safety of hot dogs
Award: Mid-Atlantic Region Excellence in Technology Transfer

Scientists: Dr**.** Charles Onwulata et al, Dairy and Functional Foods Research Unit, Wyndmoor, Pennsylvania
Title: Instant Emergency Aid Foods
Citation: For developing, implementing, and distributing an improved emergency aid food, the Instant Corn Soy Blend (ICSB), a fully-cooked food product in distribution in Haiti
Award: Mid-Atlantic Region Excellence in Technology Transfer

Scientists: Dr. Chris M. Maragos, Bacterial Foodborne Pathogens and Mycology Research Unit, Peoria, Illinois
Title: Development of Essential Antibodies
Citation: For the development of antibodies essential to the manufacture of improved toxin detection assays
Award: Midwest Region Award for Excellence in Technology Transfer

Scientist: Gillian Eggleston, Commodity Utilization Research Unit, New Orleans, Louisiana
Title: U.S. Sugar Cane and Sugar Beet Processing
Citation: For enhancing and developing the application of commercial dextranase enzymes in both U.S. sugar cane and sugar beet processing for cost savings
Award: Southeast Region Excellence in Technology Transfer Award

Scientist: Corley Holbrook, Crop Genetics and Breeding Research Unit, Tifton, Georgia
Title: Development of Tifguard
Citation: For development and transfer of Tifguard, the first high yielding peanut cultivar with resistance to both the peanut root-knot nematode and Tomato Spotted Wilt Virus
Award: Southeast Region Honorable Mention for the 2010 Excellence in Technology Transfer Awards

Scientist: Dr. Tara McHugh, Processed Foods Research Unit, Albany, California
Title: Fruit and Vegetable Food Wraps for Enhanced Nutrition
Citation: For development and transfer of fruit and vegetable films
Award: Far West Region Award For Outstanding Commercialization Success

Scientist: Dr. Larry Stanker, Foodborne Contaminants Research Unit, Albany, California
Title: Development of Monoclonal Antibodies
Citation: For development and transfer of monoclonal antibodies for the detection of antibiotic ceftiofur and its metabolites in milk
Award: Far West Region Award for Outstanding Commercialization Success

Scientist: Dr. Charles R. Brown et al, Vegetable and Forage Crops Research Unit, Prosser, Washington
Title: Tri-State Potato Breeding Program and Potato Variety Management Institute
Citation: For development and transfer of new potato varieties in the Pacific Northwest
Award: Far West Region Award for Outstanding Partnership

Scientist: Dr. Michael MacNeil, Range and Livestock Research Unit, Miles City, Montana
Title: Genetic Merit of Angus Cattle
Citation: For development of a new paradigm to predict genetic merit of Angus cattle for characteristics indicative of carcass value
Award: Mid-Continent Region Award for Notable Technology Development

Scientist: Dr. Kenneth Linthicum et al, Center for Medical, Agricultural, and Veterinary Entomology, Gainesville, Florida
Title: Global Climate Conditions
Citation: For the development of a highly innovative and effective method to forecast RVF outbreaks based on global climate conditions that determine the local and regional ecological conditions leading to the emergence of the virus in Africa
Award: Interagency Partnership Award, and Laboratory Director of the Year Award, Agricultural Research Service,

Recipient: Dr. Richard J. Brenner, Office of Technology Transfer, Beltsville, Maryland
Award: Outstanding Technology Transfer Professional Award

Technologies Highlighted in the 2010 Issue of FLC Technology for Today

Scientists: Dr. Peter Follett and Dr. Marisa Wall, U.S. Pacific Basin Agricultural Research Center, Hilo, Hawaii
Title: Irradiation Treatment Saves Fruit, Increases Exports, and Expands Market

Scientists: Dr. Tara McHugh and Dr. Carl Olsen, Processed Foods Research Unit, Albany, California
Title: Origami Foods Get Kids to Eat Their Veggies

Scientists: Dr. Phillip Klesius, Dr. Joyce Evans, and Dr. Craig Shoemaker, Aquatic Animal Health Research Unit, Auburn, Alabama
Title: Researchers Save Aquaculture Industry Through Vaccinations

Scientists: Dr. Greg Holt, Cotton Production and Processing Unit, Lubbock, Texas
Title: Eviro-Friendly Hydromulch Hits Market

Scientists: Dr. Renfu Lu, Sugarbeet and Bean Research Unit, Peoria, Illinois
Title: Researchers Worldwide Put ARS Food Tech to Use

Addendum 2

SELECTED METRIC CHARTS

Figure 1. Number of CRADAs.

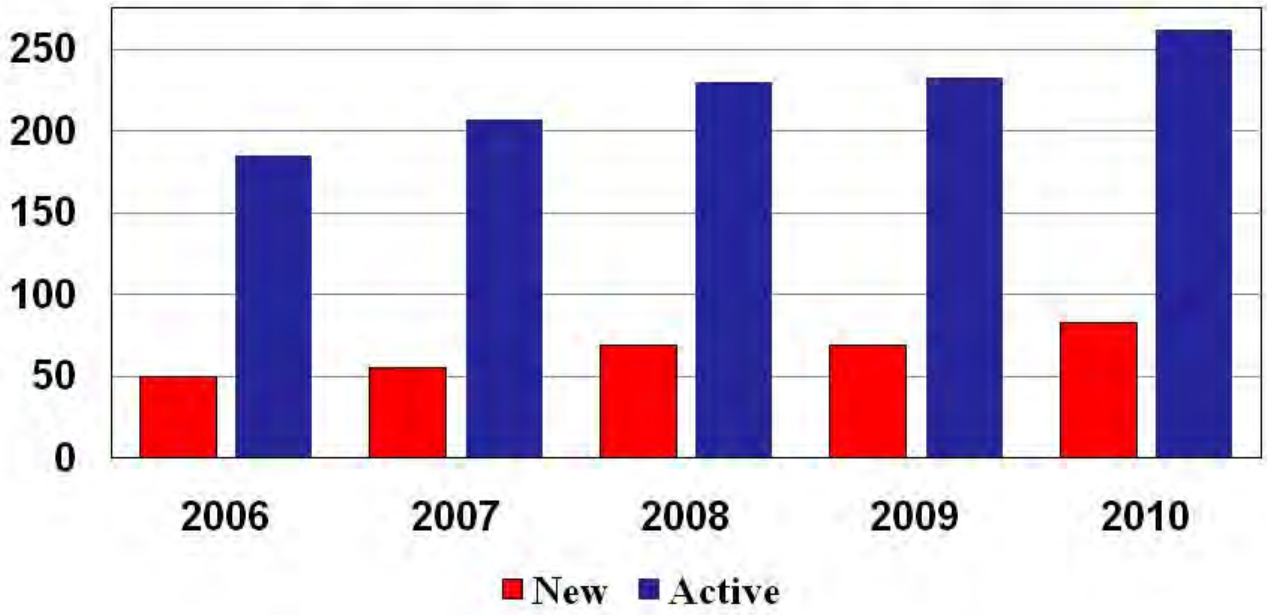
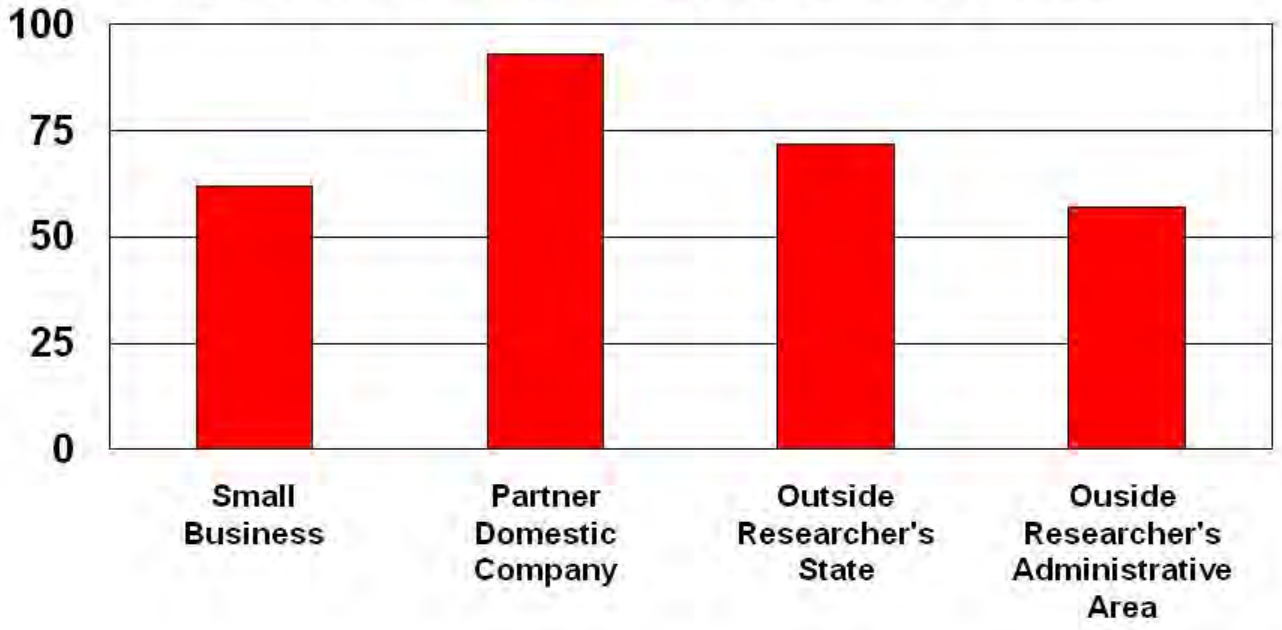


Figure 2. Statistics for 262 active CRADAs.



Note: Latter two histograms reflect ability of ARS, with its national network of research locations, to match research expertise to address problems for private sector partners across U.S.

Figure 3. Composition (%) of 323 active licenses by business type.