



U.S. Department of Agriculture Annual Report on Technology Transfer FY 2011



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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. In addition to these formal instruments, technology transfer also occurs through publications, workshops, field days, press releases and other conventional mechanisms. To assist USDA in transferring technologies to the private sector, the Agricultural Research Service (ARS) recently 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.

Despite continuing global economic recession some key metrics for FY 2011 are encouraging, such as licensing activity where 33 new licenses were executed (compared to typical 25-27). These include a number of partnerships with universities (consolidation of rights in jointly-owned inventions) and small businesses. Of 337 active licenses, 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 nearly \$4M in revenues, with nearly \$1.4 M awarded to inventors.

New Cooperative Research and Development Agreements (CRADA) executed in the FY revealed a slight decrease from the previous year. ARS continues to prioritize CRADA development for ARS scientists to offset diminishing discretionary funds while enhancing relevance to the private sector for near-term commercialization of outcomes: 78 new CRADAs were executed (previous record was 83), and 91 others were expanded. The current 275 active CRADAs for ARS scientists are valued at nearly \$160M over life of the CRADAs (up to 5 years) with \$20M in funds to ARS researchers (approx. \$5.5M during FY). Fifty-five percent 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 42 downstream outcomes from ARS science highlighted in this report include use of Material Transfer Agreements, patent available for licensing, CRADAs, invention licensing, and public release of information or plant varieties. Breadth of issues that these technologies resolve span natural resource conservation, chemical pesticide reduction and biocontrol agents; reducing animal waste runoff; pathogen detection in plants, animals, water, and foods; toxin detection in foods and soils; enhanced genetic trait analysis for breeding in cattle; biofuel crops and production / conversion technologies; and improved cover crop strategies to enhance agricultural sustainability.

Sixteen technologies are highlighted from intramural research conducted by the Forest Service. These span Xylose Fermenting Yeast, Recycled Fiber/Agricultural Fiber Panels, Cellulose Nanocrystals- Novel Templates for the Synthesis of Nanostructures, Colony Collapse of Eastern Subterranean Termites- Rapid Suppression and Elimination of Termite Colonies, and Reducing the Impact of Wildfires to name a few.

U.S. Department of Agriculture (USDA) **Annual Reporting on Agency Technology Transfer¹**

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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.

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 2,094 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 Health 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.

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, and 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. Many of these outcomes do not require a patent and subsequent license for implementation. 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 includes 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. 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), Mississippi Technology Alliance (MTA), Wisconsin Security Research Consortium (WSRC), National Association of Seed and Venture Funds (NASVF), Georgia Research Alliance (GRA), Ben Franklin Technology Development Authority (BFTDA) Kansas Bioscience Authority (KBA), Center for Innovation at Arlington, TX (CFI), California Association for Local Economic Development (CALED), and the Center for Innovative Food Technologies, Toledo, OH (CIFT; an ATIP Associate with WSRC).

ATIP greatly expands, enhances, and improves the efficiency of OTT's proactive outreach to the private sector. 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.

Our ATIP Partner, Maryland Technology Development Corporation (TEDCO) established the Rural Business Innovation Initiative (RBI²) program to enhance commercialization activities and provide technical and business assistance to small early-stage, technology-based companies in the rural areas of Maryland as defined by the Rural Maryland Council. Through this program, TEDCO and USDA-ARS partnered to hold a number of regional events, called "Maryland Rural Agriculture and Business Innovation Forums." The goal of these forums was to provide to rural farmers and businesses innovations and technology-based solutions to their regional agricultural problems.

The forum approach entailed several steps:

- (1) A series of regional listening sessions comprised of businessman, farmers, economic development, regulatory and extension personnel were held to identify a broad list of regional issues. This list included many issues, such as high-speed internet access, that did not have a research-based solution, yet would serve to identify additional needs that could be represented in the events.
- (2) From the list of rural issues, TEDCO and ARS selected those issues that were related to agriculture and had an existing research-based solution, or represented researchable issues that could be addressed by ARS.
- (3) ARS & TEDCO selected a smaller group from those that attended the first listening session for an in-depth discussion of the vetted list of rural issues.
- (4) Based upon the in-depth discussion, TEDCO & ARS selected topic areas for a one-day regional forum. The ARS and university researchers, as well as the extension personnel, and representatives from other agencies working in the topic areas were identified and invited to participate in the forum.
- (5) The forum was convened as a roundtable discussion to address the topic issues with farmers, agri-business professionals, university and ARS researchers, extension service personnel, rural development personnel, and funding and regulatory agency personnel.

In 2011, the members of ATIP established a Foundation to provide both a unifying entity for the members external to ARS, as well as flexibility to engage other organizations that have a vested interest in seeing USDA research outcomes adopted by the private sector to create goods and services for public benefit. Initial activities of the Foundation will focus on developing a common message for outreach as to the purpose, structure, and function of ATIP, mechanisms and opportunities available to the private sector companies to partner with USDA, and establishing, coordinated among the members, a calendar of themed regional showcases and forums to highlight ARS and USDA technologies and research programs.

In FY 2011 the ATIP accomplished:

- **California Association for Local Economic Development.**
Just 2 months after becoming an ATIP Partner, CalED formed and convened the ATIP Steering Committee in Albany, CA. Subsequent outreach and planning sessions included the CAL Community College Board to discuss opportunities to use ARS patent portfolio in entrepreneurship programs; the CalEd Annual Conference, Sacramento, CA,; the Oil Seed to Jet Fuel Conference, Fresno, CA, June 20-21, 2011 to discuss oil seed to jet fuel project, in support of California State University Fresno economic development modeling; the Grow California Ag Innovation Conference, Davis, CA, July 20-21, 2011 that represented the inaugural venture capital conference dedicated to ag-related technologies.
- **Center for Innovation.**
The second meeting between SPA scientists and the Center for Innovation was held in El Reno, Oklahoma, on December 3, 2010. The meeting focused on research units that did not make presentations at the first meeting in College Station. Evaluated several one page non-confidential summaries of ARS technologies for commercial potential and provided feedback to

ARS. Facilitated cooperate research between a Texas company and ARS researchers in Florida fish production. Through CFI's World's Best Technology Showcase several contacts were made with companies interested in partnering with ARS on aeroponic, ornamental grass, algae, and virus detection research. Facilitated discussions with the Department of Defense (DoD) Partnership Intermediary Agreement (PIA) member (Springboard) on ARS seed coating technology and research. CFI is a DoD , as well as an ARS, PIA member. This project demonstrates the strength of the ATIP network in making connections between DoD and ARS technologies. The Department of Interior's Bureau of Reclamation is working with CFI and ARS to identify a commercial partner for chloride resistant membrane technology. CFI also hosted a Biomass to Jet Fuel meeting in Oklahoma between ARS and the industry (WB Johnston Grain, AeCAP, LLC, Oppenheimer, Watco Companies, LLC, Center for Innovation, and Enid Regional Development Alliance) to discuss establishing regional bio-jet fuel plants and a regional biomass exchange. AeCAP would like to establish several of these biorefineries in Oklahoma, Kansas, and Texas.

- **Center for Innovative Food Technology.**

Includes an ARS technology in each CIFT member monthly newsletter. Hosted a showcase in Wadsworth, OH highlighting ARS technology and now coordinating follow up discussions with over 50 attendees to explore leads for commercial efforts. Taking the lead for ATIP on implementing ARS Urban Agriculture research. A vertical system is being installed on the property in order to evaluate varieties of crops most productive using a hydroponic approach, alternative medium options, nutrient blends for increased yields, and crop scheduling. Facilitating a project between ARS and the City of Toledo for hoop house production of vegetables with input from the ARS laboratory in Madison, WI. Finalizing an agreement with the Toledo Botanical Gardens to joint research with ARS. Working with Polymer Ohio and Ohio BioProducts Innovation Center to explore technology for commercial application to coordinate focus groups with key companies to license ARS biopolymer technologies. Working with the Ohio Soybean Council for outreach to members to implement ARS soy technologies. Facilitated the engagement of graduate students from the Dallas Hamilton Center for Entrepreneurial Leadership at Bowling Green State University to develop market analysis reports that will be presented to a targeted audience of companies.

- **Georgia Research Alliance.**

Facilitated a Collaboration Roundtable between ARS and GRA's partner universities (Georgia Institute of Technology, Georgia Tech Research Institute, University of Georgia, Emory University, and Georgia Health Sciences University) to introduce university research leaders to the array of ARS research projects and to begin exploring collaborative research relationships with commercial potential. GRA VentureLab professionals and ARS continued scanning ARS laboratories for commercialization opportunities.

- **Kansas Bioscience Authority.**

Met with Northern Plains Area scientists on animal health and food safety research. KBA facilitated collaborative research with a Kansas company and ARS scientists located in TX on pesticide encapsulation. Facilitated discussions between the Why Kansas Bio-Jet/Green Diesel Consortium, ARS, and USDA-Rural Development. The purpose of the Why Kansas meeting was to explore locating one or more green diesel/bio- jet biorefineries in Kansas. The meeting was attended by several economic development groups from central Kansas, the Kansas Department of Commerce, the mayor of Greenburg, Kansas, the Kansas Alliance for Biorefining and

Bioenergy (funded by KBA), and Honeywell UOP. The issues addressed at the meeting related mostly to feedstock choice. Co-hosted the Biofuels Showcase, which was coordinated in conjunction with the National SBIR Conference, with the Wisconsin Security Research Consortium.

- **Mississippi Technology Alliance.**

Conducted a webinar on “Partnering with ARS” to identify the research capacity of ARS and explain how private companies could conduct collaborative research with ARS. MTA also distributed to potential cooperators one page non-confidential summaries of ARS technologies for commercialization. Facilitated collaborative research with a Mississippi company and ARS scientists at the ARS National Biological Control Laboratory (NBCL) in Mississippi. Organized a conference between MTA, ARS, Mississippi State University Sustainable Energy Research Center and a company in Tennessee. This meeting helped establish new interdisciplinary teams and strengthen research capacities and technology transfer with a goal of commercializing research results.

- **Maryland Technology Development Corporation.**

Conducted three Maryland Rural Agriculture and Business Innovation Forums. Focus of the Lower Shore Forum was on ornamental plant production, watershed management, green poultry production. The Southern Maryland Forum focused alternative crops (potatoes, catnip, and lavender), sustainable land management, and land conservation. The Northeastern Forum focused on winter crops, regional slaughterhouse facilities, bovine breeding, small farm equipment and deer and small woodlands management. From each Ag Forum, there were lessons learned for improvement so the planning and the programs evolved over time. One important component we learned early on was to engage the local extension folks in planning and participating in the forums. They work closely with the farmers and can speak to the issues. The Ag Forums have brought relevant ARS technologies to farmers and other agri-businesses. A farmer has started year-round strawberry production as a high value crop to increasing farm profitability. The farmer learned of the strawberry technology through one of the Ag Forums. Also, on the Eastern Shore, a potato project has been implemented by a UM Extension Service Agent. The project will utilize ARS crop modeling technology to better advise farmers on potato scheduling and production. TEDCO hosted a tour of the Beltsville ARS campus for extension agents. They facilitated the engagement of students from the Achieving the Commercialization of Technology in Ventures through Applied Training for Entrepreneurs (ACTiVATE) program, Eastern Shore Entrepreneurship School, and Howard County Committee College to develop business plans for 6 ARS technologies. TEDCO facilitated ARS involvement in the Chesapeake Bay Commission’s Manure-to-Energy Summit. They hosted the Power of Five, an angel forum, which highlighted two ARS commercial partners. TEDCO volunteered to serve as the ATIP Foundation Secretary.

- **National Association of Seed and Venture Funds..**

During this fiscal year, NASVF focused on outreach and workshops describing the ATIP network and highlighting economic impacts of private sector adoption of ARS innovations. These presentations and workshops describe how the private sector accesses USDA technologies and how they may engage ARS scientists in joint research through Cooperative Research and Development Agreements. NASVF also distributes the “Economic Impact Research Report: CrispTek”, that describes the licensing -- of an ARS technology developed in New Orleans – to a startup company in Maryland. The report shows that, as a result of this product production from

this recent commercialization, the economic impact is distributed in 4 state (MD, IL, TX, IA). By 2014, 95 jobs are expected to be created from this one food technology. The informational outreach efforts included the annual NCET2 conference, annual SBIR/STTR conference, Federal Laboratory Consortium regional (3) and national meetings, the Minority Emerging Business Leaders national conference, the national Business Incubator Association, the Tech Town Project managers meeting, and the Tennessee South Central District Meeting. International outreach presentations were conducted in St. Petersburg, Moscow, and Perm Russia.

- **Pennsylvania Ben Franklin Technology Development Authority.**

The BFTDA underwent restructuring for most of FY 2011. Activity under ATIP was limited to participating in a training sessions of ARS scientists at ARS laboratories in the North Atlantic Area on technology transfer and commercialization, providing some private sector perspectives. A strong relationship was established with the Pennsylvania Department of Agriculture, and PDA personnel participating in the ATIP annual meeting convened in Beltsville, MD in June.

- **Wisconsin Security Research Consortium.**

Several programs were developed including the Biofuels Showcase, which was coordinated in conjunction with the National SBIR Conference, convened in April in Madison, WI. This event was developed in partnership with the Kansas Bio Science Authority and brought together researchers, user constituent groups, investors and small businesses. The one-day event was designed to inform participants about potential biofuels markets, provide information about the current biofuels research on both the national and regional levels, as well as provide information about patented technologies from USDA available for commercialization. The event also served to inform the investment community (angel networks and venture capital groups) that there is strong interest in the development of biofuels. Presenters and participants included National Program Leaders from ARS and Forest Products Laboratories, representatives from the University of Wisconsin Madison, Kansas Biofuels Alliance, Wisconsin Bioenergy Institute, as well as the Wisconsin Alumni Research Foundation. User constituent groups included the Technical Advisor for Fuels and Energy from the Air Force Research Lab and a representative from the Commercial Aviation Alternative Fuels Initiative (part of the Airline Transport Association). They provided insight as to the direction and tactics their respective organizations will take in the future to stabilize fuel costs with the use of biofuels as well as to assure adequate supply of fuel for their industries. WSRC also engaged entrepreneurial programs with the University of Wisconsin (UW) System College Business School partnerships, including UW Oshkosh and the U W Whitewater. USDA technologies (issued patents) serve as class projects to develop business and marketing plans. These are then available to entrepreneurs and small-to-medium enterprises who might consider licensing the technology from USDA. Arrangements are now being made to expand this program to UW – Platteville that has both a business school and an engineering school. WSRC / UW Plattville plan to develop teams using students from both the business and engineering school that will create a more robust business case for commercialization purposes.

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 2011:

ARS continues to prioritize CRADA development for ARS scientists to offset diminishing discretionary funds while enhancing relevance to the private sector for near-term commercialization of outcomes: 78 new CRADAs were executed (previous record was 69), and 91 others were expanded. The current 275 active CRADAs for ARS scientists are valued at nearly \$160M over life of the CRADAs (up to 5 years) with \$20M in funds to ARS researchers (approx. \$5.5M during FY). 55% 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 ARS licensing program has a strong emphasis on partnerships with universities and small businesses. 33 new licenses were executed. Of 337 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 \$3.9M in revenues; over \$1.3 M was awarded to inventors.
- We received 137 new invention disclosures, and completed committee review of 88. A record 133 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 issued.
- Finished the development of a new Web-based module (Salesforce) 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 and allow OTT the ability to work with ONP on interactions with new Stake Holders. This list will also incorporate RSS feeds to "Data.Gov" the "FLC" and other related web sites.
- Began a new program to coordinate discussion between researchers, line-management at the Area Offices, and National Program Leaders on developing a collaborative research approach for overlapping projects. By coordinating the research, a more efficient and effective technology transfer strategy can be developed. This program has resulted in several ARS-wide interdisciplinary research teams that have been successful in forming new research collaborations and successful technology transfer. In addition, uniform policies and procedures for collaborating with commercial partners are being developed.
- Led an effort with Line-Management (LM), Office of National Programs (ONP) and Extramural Agreements Divisions (EAD) to develop a standardized procedure for the approval of all research agreements. A new template was created for the incoming agreements section of ARIS that provides all the information necessary for OTT, EAD, LM and ONP to approve an agreement. This process will reduce the number of agreements with conflicting IP.
- Led an ATIP effort to expand the Forum concept throughout the U.S. Working with various University Cooperative Extension Services to help in planning and hosting forums. Involved NIST-MEP and EPA in expanding the manufacturing and regulatory components of the Forums.
- OTT Licensing and Patenting Staff are working with researchers and the National Program Leaders when they are developing their research plans in order to increase research impact. In the

past, the researchers were only interacting with OTT Licensing and Patenting Staff after the research was completed.

- Through ATIP, OTT is providing summaries of research technologies to community colleges for use as business school class projects. In the past, class projects resulted in novel and successful business plans for commercializing technologies that were difficult to license. In addition, this program is increasing the educational opportunity of the next generation of entrepreneurs.
- Working with other USDA agencies, NIST, NIH, EPA, DoD and DOI to develop a collaborative technology transfer strategy for related IP. Started the development of formal agreements for these partnerships.
- 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. In FY2011, a tenant occupied space and began collaborative research with ARS.
- Created a new position (Coordinator, Partnerships and Grants) to facilitate the creation of partnerships. Established core principles for when ARS scientists are seeking partnerships and soft funding that mandates such activities must be complementary and supportive of their appropriated funds project and approved by ARS National Program Leadership and Line Management. Developed a newsletter to inform researchers of partnership opportunities and to educate ARS scientists and administrative personnel about partnership and agreements policies, procedures, and best practices. Obtained webinar and other training materials to guide scientists in proposal writing.

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

CRADA's and Other R&D

Agricultural Research Service (ARS)	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
• CRADAs, total active in the FY	207	230	233	262	275
- New, executed in the FY	55	69	69	83	78
▪ Traditional CRADAs, total active in the FY	184	202	191	208	190
- New, executed in the FY	47	63	51	59	57
▪ Non-traditional CRADAs, total active in FY	23	28	42	54	85
- New, executed in the FY	8	6	18	22	21
▪ Material Transfer - CRADA, total active in the FY	5	3	10	16	29
- New, executed in the FY	2	1	7	10	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	10	12	15	18	32
- New, executed in the FY	3	3	5	7	9
▪ Foreign - CRADA, total active in the FY	7	12	16	19	23
- New, executed in the FY	3	2	6	5	2
• Amendments¹, total in the FY	77	76	74	91	91
• Scientific Germplasm Releases (Public & Protected)	N/A	N/A	58	86	56
• Other Collaborative R&D Relationships, total active in the FY²					
▪ Confidentiality Agreements					
- New, executed in the FY	329	270	251	246	309
▪ Material Transfer Agreements					
- New, executed in the FY	788 ³	884 ⁴	784 ⁵	885 ⁶	1038 ⁷
▪ Other Agreements, total active in the FY	4,084	5,466	9,960	11,214	13,007
- New, executed in the FY	1,159	1,729	1,381	1,273	1,525
• Animal and Plant Health Inspection Service (APHIS)					
▪ CRADAs, total active in the FY	3	3	4	3	6
- New, executed in the FY	1	0	1	1	5
▪ Material Transfer					
- New, executed in the FY	6	3	3	3	7
▪ Confidentiality Agreements					
- New, executed in the FY	4	4	6	11	35
• Forest Service (FS)					
▪ CRADAs, total active in the FY	20	19	22	22	17
- New, executed in the FY	13	7	9	15	5
▪ Joint Venture Agreements – Active	N/A	N/A	N/A	N/A	94
- New, executed in the FY	N/A	N/A	N/A	N/A	58

Footnotes for Table 1

¹ Amendments extend existing CRADAs for additional years to a maximum of 5 years, and/or change Statements of Work, and/or change funding levels.

² Includes Trust Fund Agreements, Reimbursable Agreements, and Non-Funded Cooperative Agreements.

³ Includes 564 processed for outgoing materials, representing research outcomes of interest to other researchers and private sector companies.

⁴ Includes 648 processed for outgoing materials, representing research outcomes of interest to other researchers and private sector companies.

⁵ Includes 550 processed for outgoing materials, representing research outcomes of interest to other researchers and private- sector companies.

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⁶ Includes 633 processed for outgoing materials, representing research outcomes of interest to other researchers and private- sector companies.

⁷ Includes 672 processed for outgoing materials, representing research outcomes of interest to other researchers and private- sector companies.

TABLE 2. Invention Disclosure and Patenting

Agricultural Research Service (ARS)	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
● New invention disclosures in the FY	124	133	153	146	137
● Patent applications filed in the FY	107	114	117	106	133
▪ Non-Provisional	68	74	86	73	96
▪ Provisional	39	40	31	32	37
● Patents issued in the FY	35	27	21	42	54

Forest Service (FS)	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
● New invention disclosures in the FY	2	0	1	18	15
● Patent applications filed in the FY	7	9	6	6	9
▪ Non-Provisional	5	5	4	3	2
▪ Provisional	2	4	2	3	7
● Patents issued in the FY	2	3	3	2	3

TABLE 3. Licensing: Profile of Active Licenses ¹

Agricultural Research Service (ARS)	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
● All licenses, number total active in the FY	327	315	316	323	337
◦ New, executed in the FY	25	27	25	22	33
▪ Invention licenses, total active in the FY	327	315	316	323	337
◦ New, executed in the FY	25	27	25	22	33
- Patent licenses, total active in FY	327	291	288	292	301
◦ New, executed in the FY	24	23	21	18	27
- Material transfer (invention), total active in FY	22	24	28	3	36
◦ New, executed in the FY	5	4	4	4	6

Forest Service (FS)	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
● All licenses, number total active in the FY	12	13	13	20	20
◦ New, executed in the FY	0	1	0	0	2
▪ Invention licenses, total active in the FY	12	13	13	20	20
◦ New, executed in the FY	0	1	0	0	2

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.

TABLE 4. Income Bearing Licenses¹

Agricultural Research Service (ARS)	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
• All income bearing licenses, number	337	313	314	321	335
◦ Exclusive	241	223	222	230	239
◦ Partially exclusive	24	20	20	16	16
◦ Non-exclusive	72	70	72	75	80
▪ Invention licenses, income bearing	337	313	314	321	335
◦ Exclusive	241	223	222	230	239
◦ Partially exclusive	24	20	20	16	16
◦ Non-exclusive	72	70	72	75	80
- Patent licenses, income bearing	315	289	286	290	299
◦ Exclusive	238	220	218	226	234
◦ Partially exclusive	24	20	20	16	16
◦ Non-exclusive	53	49	48	48	49
- Material transfer (invention) licenses, income bearing	22	24	28	31	36
◦ Exclusive	3	3	4	4	5
◦ Partially exclusive	0	0	0	0	0
◦ Non-exclusive	19	21	24	27	31
• All royalty bearing licenses, number ¹	106	112	129	125	130
▪ Invention licenses, royalty bearing	106	112	129	125	130
- Patent licenses, royalty bearing	101	104	120	113	119
- Material transfer (invention) licenses, royalty bearing	5	8	9	12	11

Footnotes for Table 4

¹Totals include only those licenses that actually *received* royalty income.

TABLE 5. Licensing Management

Agricultural Research Service (ARS)	FY 2007 ¹	FY 2008 ²	FY 2009 ³	FY 2010 ⁴	FY 2011 ⁵
• Number of licenses					
▪ Invention licenses, total active in the FY	339	315	316	323	337
◦ New, executed in the FY	25	27	25	22	33
• Elapsed execution time, licenses granted in the FY					
▪ Invention licenses					
◦ average (months)	8.9	4.8	6.7	6.6	5.9
◦ median (months)	8.2	5.0	6.8	6.4	3.3
◦ minimum (months)	2.6	0.5	0.7	0.7	0.6
◦ maximum (months)	23.7	11.4	18.4	18.5	18.2
- Exclusive and partially exclusive invention licenses					
◦ average (months)	11.6	7.3	9.7	5.7	10.3
◦ median (months)	9.3	6.6	7.9	5.6	9.9
◦ minimum (months)	3.0	3.9	5.5	2.3	5.1
◦ maximum (months)	23.7	11.4	18.4	9.2	18.2
- Non-exclusive invention licenses					
◦ average (months)	6.9	2.3	3.2	8.3	2.0
◦ median (months)	8.2	1.0	1.8	9.4	2.0
◦ minimum (months)	2.6	0.5	0.7	0.7	0.6
◦ maximum (months)	11.5	6.0	8	18.5	3.3
▪ Patent invention licenses					

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▫ average (months)	9.6	7.2	8.2	6.1	8.6
▫ median (months)	7.2	6.0	7.3	5.6	6.2
▫ minimum (months)	2.6	3.9	1.2	2.3	1.0
▫ maximum (months)	23.7	11.4	18.4	11.9	18.2
- Exclusive and partially exclusive patent invention licenses					
▫ average (months)	11.6	7.3	10.1	5.3	11.3
▫ median (months)	9.3	6.6	8.4	4.8	13.5
▫ minimum (months)	3.0	3.9	5.5	2.3	5.1
▫ maximum (months)	23.7	11.4	18.4	9.2	18.2
- Non-exclusive patent invention licenses					
▫ average (months)	6.5	6.0	1.3	11.9	1.9
▫ median (months)	6.4	6.0	1.3	11.9	1.9
▫ minimum (months)	2.6	6.0	1.2	11.9	1.0
▫ maximum (months)	11.5	6.0	1.4	11.9	2.7
▪ Material transfer (invention) licenses					
▫ average (months)	7.3	1.8	4.4	7.6	2.6
▫ median (months)	9.2	0.6	4.7	8.5	2.3
▫ minimum (months)	3.0	0.5	0.7	0.7	0.6
▫ maximum (months)	9.2	5.8	8	18.5	5.4
- Non-exclusive material transfer (invention) licenses					
▫ average (months)	7.3	1.8	4	7.4	2.1
▫ median (months)	9.2	0.6	3.7	5.3	2.0
▫ minimum (months)	3.0	0.5	0.7	0.7	0.6
▫ maximum (months)	9.2	5.8	8	18.5	3.3
• 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 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.

² 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.

³ 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.

⁴ 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.

⁵ During FY 2011, USDA received 29 new invention license applications, for which 4 new licenses were granted, 21 license agreements are currently in negotiation, 0 applications were withdrawn by the applicants, and 4 applications are on hold by request of the applicant. The FY 2011 data is based upon 13 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

Agricultural Research Service (ARS)	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
• Total income, all patent invention licenses active in the FY	\$3,588,148	\$3,953,415	\$5,376,463	\$3,641,476	\$3,989,228
▪ Invention licenses	\$3,588,148	\$3,953,415	\$5,376,463	\$3,641,476	\$3,989,228
- Patent licenses	\$3,521,739	\$3,883,922	\$5,318,483	\$3,566,048	\$3,854,820
- Material transfer (invention licenses)	\$46,409	\$69,493	\$57,980	\$75,428	\$134,408
▪ Other IP Licenses	\$0	\$0	\$0	\$0	\$0
• Total Earned Royalty Income (ERI)	\$2,681,552	\$3,009,774	\$4,422,023	\$3,075,199	\$3,136,813
◦ Median ERI	\$4,657	\$4,258	\$4,485	\$4,911	\$4,748
◦ Minimum ERI	\$12	\$7	\$12	\$2	\$6
◦ Maximum ERI	\$388,730	\$761,553	\$1,715,890	\$331,674	4630,847
◦ ERI from top 1% of licenses	Not presented ¹	Not presented ¹	Not	Not presented ¹	Not presented ¹
◦ ERI from top 5% of licenses	\$1,230,251	\$1,657,059	\$2,756,811	\$1,493,456	\$1,932,197
◦ ERI from top 20% of licenses	\$2,205,066	\$2,543,565	\$3,874,292	\$2,540,101	\$2,672,414
▪ Invention licenses, total ERI	\$2,681,552	\$3,009,774	\$4,422,023	\$3,075,199	\$3,136,813
◦ Median ERI	\$4,657	\$4,258	\$4,485	\$4,911	\$4,748
◦ Minimum ERI	\$12	\$7	\$12	\$2	\$6
◦ Maximum ERI	\$388,730	\$761,553	\$1,761,890	\$331,674	\$630,847
◦ ERI from top 1% of licenses	Not presented ¹				
◦ ERI from top 5% of licenses	\$1,230,251	\$1,657,059	\$2,756,811	\$1,493,456	\$1,932,197
◦ ERI from top 20% of licenses	\$2,205,066	\$2,543,565	\$3,874,292	\$2,540,101	\$2,672,414
- Patent (and patent application) licenses, total ERI	\$2,662,122	\$2,982,281	\$4,386,042	\$3,014,771	\$3,067,390
◦ Median ERI	\$4,662	\$4,579	\$4,612	\$5,000	\$4,800
◦ Minimum ERI	\$89	\$45	\$117	\$2	\$6
◦ Maximum ERI	\$388,730	\$761,553	\$1,715,890	\$331,674	\$630,847
◦ ERI from top 1% of licenses	Not presented ¹				
◦ ERI from top 5% of licenses	\$1,230,251	\$1,544,031	\$2,756,811	\$1,493,456	\$1,855,388
◦ ERI from top 20% of licenses	\$2,178,046	\$2,485,319	\$3,819,292	\$2,485,208	\$2,628,537
- Material transfer (invention licenses), total ERI	\$19,430	\$27,493	\$35,980	\$60,428	\$69,423
◦ Median ERI	\$3,428	\$1,003	\$3,186	\$1,705	\$2,000
◦ Minimum ERI	\$12	\$7	\$12	\$42	\$37
◦ Maximum ERI	\$9,784	\$9,508	\$13,690	\$17,988	\$22,867
◦ ERI from top 1% of licenses	\$9,784	\$9,508	\$13,690	\$17,988	\$22,867
◦ ERI from top 5% of licenses	\$9,784	\$9,508	\$13,690	\$17,988	\$22,867
◦ ERI from top 20% of licenses	\$9,784	\$18,573	\$21,282	\$32,711	\$42,241
Forest Service (FS)	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
• Total income, all licenses active in the FY	\$46,080	\$25,015	\$6,655	\$5,506	\$15,340
▪ Invention licenses	\$46,080	\$25,015	\$6,655	\$5,506	\$15,340
- Patent licenses	\$46,080	\$25,015	\$6,655	\$5,506	\$15,340

Footnotes for Table 6

¹ Represents a single license.

TABLE 7. Disposition of License Income

Agricultural Research Service (ARS)	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
• Income distributed¹					
▪ Invention licenses , total distributed	\$3,158,217	\$3,013,552	\$3,673,922	\$3,137,670	\$3,220,920
◦ To Inventors	\$1,015,450	\$756,458	\$1,371,346	\$1,370,296	\$1,391,111
◦ To Others	\$1,344,186	\$562,427	\$1,633,536	\$1,179,579	\$1,181,859
- Patent licenses, total distributed	\$3,114,853	\$2,958,996	\$3,631,660	\$3,084,726	\$3,202,394
◦ To inventors	\$990,344	\$728,892	\$1,346,512	\$1,341,289	\$1,391,111
◦ Salaries of some technology transfer staff	\$1,325,928	\$1,535,437	\$1,616,108	\$1,155,642	\$1,166,333
◦ Patent filing preparation, fees, & patent annuity payments	\$798,581	\$694,667	\$669,040	\$587,795	\$647,950
◦ Other technology transfer expenses	\$0	\$0	\$0	\$0	\$0
- Material transfer (invention) licenses, total distributed	\$43,364	\$54,556	\$42,262	\$52,944	\$63,271
◦ To inventors	\$25,106	\$27,566	\$24,834	\$29,007	\$47,745
◦ Salaries of some technology transfer staff	\$18,258	\$26,990	\$17,428	\$23,937	\$15,526
◦ 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 2007	FY 2008	FY 2009	FY 2010	FY 2011
• Income distributed					
▪ Invention licenses , total distributed	\$15,890	\$8,500	\$6,000	\$5,506	\$15,340
◦ To Inventors	\$15,890	\$8,500	\$6,000	\$5,506	\$15,340
◦ To Others	\$0	\$0	\$0	\$0	\$0
- Patent licenses, total distributed	\$15,890	\$8,500	\$6,000	\$5,506	\$15,340
◦ To inventors	\$15,890	\$8,500	\$6,000	\$5,506	\$15,340
◦ To Others	\$0	\$0	\$0	\$0	\$0

Footnotes for Table 7

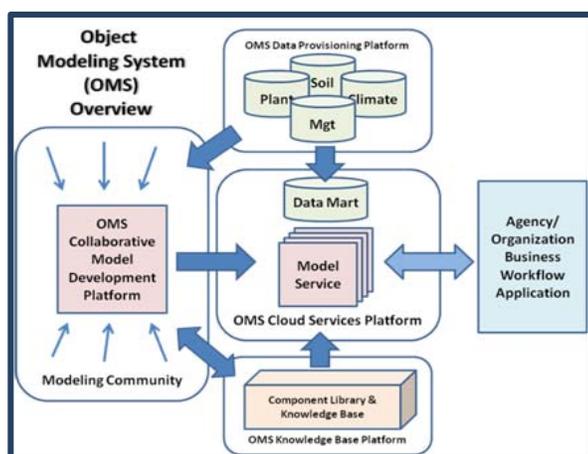
¹ Some of the income distributed reflects income received in the prior fiscal year.

DOWNSTREAM OUTCOMES FROM ARS TECHNOLOGY TRANSFER ACTIVITIES

NATURAL RESOURCES AND SUSTAINABILITY

- 152 Research Projects
- 68 Locations
- 464 Scientists

An Object Modeling System (OMS) Streamlines the Development and Delivery of Models and Tools to Help Conservation of Natural Resources



Development of environmental models and tools to help conservation of natural resources is expensive and time consuming; modular modeling frameworks (EMFs) have emerged as an answer to more easily development and delivery of such environmental models and tools. ARS scientists, with NRCS and Colorado State University (CSU) collaborators in Fort Collins, CO, have developed and released the Object Modeling System (OMS) for this purpose. The OMS version 3.1 includes numerous improvements and better methodology for developing and connecting science components in FORTRAN, in addition to the Java based components in earlier versions. A new Cloud Services Innovation Platform

(CSIP), involving the use of multiple computers, was developed to run the large and complex models quickly and remotely, with OMS as the underlying vehicle for modeling. The OMS platform also includes a uniform standard program for determining model parameters, sensitivity and uncertainty analyses, and visualization. The OMS was officially transferred to NRCS in 2008. The NRCS is using it to streamline the development, maintenance, and delivery of models and tools for conservation. They are using an OMS-based model for water supply forecasting. The Revised Universal Soil Loss Equation 2 (RUSLE2) model was successfully tested as a cloud computer application under CSIP. The ARS has developed and new watershed scale model for use by the NRCS for Conservation Effects Assessment. The technology was transferred through a public release. *Agricultural Systems Research Unit (ASRU), Fort Collins, CO*

Modified Grain Bin Floor

Grain bins are a common sight in rural America. However, many go unused because they are old, leak or have cracked foundations. ARS researchers in Texas have designed a method to modify grain bin floors to refurbish older, unused grain bins for a fraction of the cost of replacement. This new funnel-shaped floor system is efficient, easy to install, keeps grain off of the bin floor, and prevents grain from



standing in moisture. The slope of the floor allows grain to move to the center of the bin for removal by an auger via gravity, and thus, does not require a motorized sweeper. The modified grain bin floor system allows easy auger access for removing grain. This affordable, easy to install invention will allow the use of old and unused grain bins already standing to be utilized without the cost of purchasing a new bin. The technology was transferred through a public release and several U.S. farm storage companies have expressed interest in the technology and are currently evaluating it. *Grassland, Soil and Water Research Laboratory (GSWRL), Temple, TX*

Biological Control of Giant Reed



ARS researchers have identified the Arundo wasp as a biocontrol agent for giant reed. Originally, giant reed was introduced into North America in the 1500s by the Spanish for its fiber uses such as basket weaving. It quickly became naturalized and spread. The plant has invaded several thousand acres of the Rio Grande riparian area. Giant reed is very hearty, consumes large quantities of water, and can grow up to 30 ft. tall in stemmed, cane-like clumps. Extensive testing by ARS researchers has shown that the Arundo wasp only feeds and completes its life cycle on giant reed. It will not harm any native or economically important plants, including the native common river reed. This makes the wasp an excellent candidate to use as a biological control agent for giant reed. The Arundo wasp cannot sting or bother humans, domestic animals or wildlife in any way. Arundo wasps are very weak fliers and will not move away from the stands of Arundo along the river. Federal and State

Agencies are working to control the damage done by *Arundo donax*, yet much remains to be learned. These studies however, give scientists and stream keepers alike new knowledge that they can use to stop the advance of this aggressive invader. The technology was transferred through research publication. *Kika de la Garza Subtropical Agricultural Research Center, Weslaco, TX*

Smartphone Applications for Spray Atomization



ARS researchers have developed two smartphone applications (apps) that allow users, at any time and in any place, to conveniently quantify the size of spray droplets created by high-speed aerial spray application, or ground-based vector control spray equipment. These smartphone apps are the first to be developed by ARS. The two apps, released to and immediately accepted and implemented by the user communities, are based on years of research and combine spray nozzle models and sprayer evaluation datasets into readily accessible and searchable databases. Both smartphone applications guide users through inputting their specific spray application scenarios, and produce a quantitative summary of the calculated spray droplet sizes. Generated data

can be conveniently archived and e-mailed for future reference and record-keeping purposes. By creating models with greater ranges of inputs, the amount of time and resources needed to generate the measurement data are significantly reduced. This technology was transferred through public release.
Areawide Pest Management Research Unit, College Station, TX

Boll Weevil Migrant Detection and Tracking



A multidisciplinary USDA-ARS team developed a highly-effective technology package (boll weevil migrant detection and tracking technology) that facilitates cost-effective protection of boll weevil eradication zones from re-infestation. Real-world application of the package has improved detection of weevil populations and their source regions by identifying weevil genetics and pollen taxa associated with captured weevils, enhancing the use and interpretation of pheromone traps, and simulating weevil migratory flight pathways. In response to critical pest management issues raised by Boll Weevil Eradication Program Leaders, APHIS, the National Cotton Council, Cotton Incorporated, and other major cotton stakeholders, the team through sustained effort developed, reported and transferred the technologies for operational implementation in the Eradication Program.

With financial support from the Cotton Foundation and after training by ARS team members, APHIS is now capable of performing the genetics work necessary to conduct weevil population assignment analyses. Adoption and effective application of this boll weevil migrant detection and tracking technology package has over the past several years resulted in direct savings to the cotton industry in excess of \$1M annually and has greatly enhanced the capability of the Eradication Program to efficiently protect against and mitigate re-infestations in post-eradication. This Technology was transferred through public release. Beneficial Insects Research Unit, Weslaco, TX

Cover Crop, Rye, Residue, and In-Furrow Treatment Effects on Thrips

Feeding damage on seedling cotton and peanuts caused by thrips (tiny, slender insects with fringed wings) has deleterious effects on growth and yield. Most growers use an in-furrow treatment of pesticide which has lethal and sub-lethal effects on a diversity of non-target species. Thus, an alternative thrips control option would be desirable. ARS researchers found that rye residue ground cover alone decreases the number of thrips and their damage in both cotton and peanuts, and that a winter crimson clover cover with an in-furrow treatment of diammonium phosphate fertilizer added additional plant protection from thrips in cotton. Thus, the use of conservation tillage and cover crops with an in-furrow treatment of a fertilizer provides an alternative thrips management strategy in cotton production. This technology was transferred through publication.
Crop Protection & Management Research Unit, Tifton, GA



Development of Biomass for use in Mycelium-Based Biodegradable Packaging



ARS has been responding to industry concerns about the growing disposal cost and associated environmental and legal problems of mass quantities of cotton gin byproducts (gin waste) being generated and accumulating at cotton gins by developing patented techniques and processes that transform the cotton waste biomass into value-added products. One of the' growing environmental and legal issues that has arisen lately is the concern of large quantities of old storage cotton gin byproducts spontaneously catching fire causing severe smoke and odor issues. By taking the byproduct and turning it into a valuable resource, the product is not treated as waste but as a useful commodity. This technology involved selection of processing equipment and development of choice blends of biomass materials for use in a CRADA partner's technology of making 100% biodegradable molded packaging and insulation board products out of fungal mycelium and biomass. The CRADA partner's technology entails using fungal species to grow on a biomass substrate blend so that the specified parts are grown into the desired shapes. Once the fungi has grown into the desired shape, the part is dried and the fungal growth is terminated resulting in a 100% biodegradable formed piece that is intended to replace polystyrene packaging material and insulation boards. As a result of the research, the ARS CRADA partner was able to launch their molded packaging material, with two Fortune 500 companies in the summer of 2010 and is currently developing products for a U.S. electronics company. The product continues to draw interest from other companies both domestically and internationally. Recently, Dell Computer announced they will be using this packaging for their servers. Currently, Ecovative employs 26 people and continues to grow. In 2011, this biodegradable packaging will replace several hundred thousands of dollars of styrofoam packaging. CRADA partner is producing and shipping several thousand pieces every week with production heading toward 5000 units a week. This Technology was transferred through the use of a CRADA. Cotton Production & Processing Research Unit, Lubbock, TX

Species Suitable for Northern U.S. Green Roofs Identified



Installation of green roofs is a new strategy to reduce the environmental impacts of buildings, while reducing building energy costs. In cooperation with the University of Minnesota, ARS scientists identified 42 plant species can survive on rooftops in the Twin cities area (a cold northern climate). A variety of desirable environmental impacts on each of those species was tested on a rooftop in Minneapolis and, could be used to reduce building operating costs. This information is being integrated into the Minneapolis planning departments building code requirement related to green roofs. This technology was transferred through a scientific publication. *Application Technology Research Unit Wooster, OH*

Screwworm Barrier Training

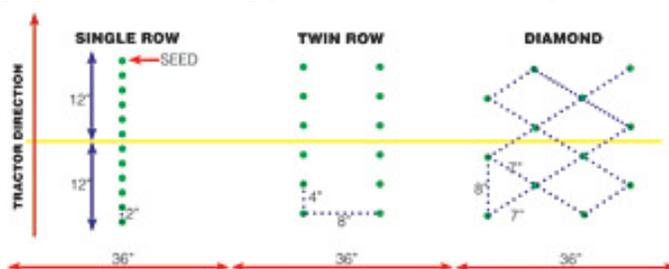
The U.S. Department of Agriculture led, with collaboration for our friends to the south, a successful effort to eradicate screwworms from the U.S., Mexico and Central America. There is now a barrier against the invasion of screwworms at the Panama to Colombia border. The Panama – U.S. Commission for the Eradication of Screwworm (also known as COPEG, an international entity with personnel from USDA-APHIS and the Panamanian Ministry of Agriculture) is responsible for maintaining this barrier.



Successful maintenance of the barrier relies heavily on the accurate identification of screwworm myiasis ‘cases’ by capable, trained personnel. At COPEG’s request, the Screwworm Research Unit (satellite of KBUSLIRL), is holding periodic training sessions conducted by Dr. Agustin Sagel. Dr. Sagel is a Foreign Service National working with the Screwworm Research Unit in Panama and is an expert in the identification of fly larvae (maggots that would be in myiasis wounds). In February, 2011, he trained 3 individuals with COPEG in accurate identification of screwworm myiasis ‘cases.’ This training has led to the existence of a ‘pool’ of capable individuals to identify suspect samples of fly larvae, critical to successful maintenance of the barrier against this insidious pest, and has lifted the standing of COPEG as the official ‘world laboratory’ for screwworms as recognized by the OIE (World Organization for Animal Health). Future training will be supplied as necessary. *The Knippling-Bushland U.S. Livestock Insects Research Laboratory, Kerrville, TX*

Diamond Row Pattern Planter

An experimental planter was designed and constructed to plant peanuts in a diamond-shaped pattern. Preliminary results indicated significantly higher yields were possible when the distance between adjacent peanut plants is maximized. The diamond planting pattern maximizes this distance for a fixed population. Planting peanuts in a diamond pattern, rather than in a single row, reduces plant-to-plant



competition and increases yield. The planter transfers a constant rate of seed from a hopper to a gang of eight pairs of offset disk openers. The unique aspect of this machine is its perforated rotating drum that simultaneously picks up eight seed (one for each pair of disk openers) using a perforated rotating cylinder operating under a vacuum. At the precise moment dictated by the

producer's desired plant spacing, drum-to-seed vacuum is broken and seeds are planted in a diamond pattern after falling down drop tubes attached to disk openers. The planter solves the problems of: (1) reduced yield caused by excessive plant competition (for a plant spacing of 6 seed per foot the nearest competing plants are 2 inches away for single, 4 inches for twin, and over 7 inches for diamond planting patterns); and (2) devising a mechanized device that can commercially plant peanuts in a diamond-shaped pattern. Greater weed and disease suppression has been associated with rapid canopy coverage. The diamond planting pattern will accelerate the rate of canopy coverage. This technology was transferred through a patent and licensing. *The National Peanut Research Laboratory Dawson, GA*

New ARS-Developed Technology Curbs Nutrient Runoff to the Chesapeake Bay



A research partnership consisting of three ARS research units and six land grant Universities, developed a new technology of subsurface application of dry manure and poultry litter. The group quantified the technology's benefits in terms of increasing crop yields as well as reducing nutrient losses and odor emissions to the environment under the minimum tillage crop production system, the "Subsurver". The key to the success of this partnership has been the linkage between the research experience and expertise in nutrient management and impacts on water quality embodied within ARS and the state-wide extension programs led by the university partners, who are recognized and trusted by farmers within their respective states. Based on results produced by this partnership, the U.S. Environmental Protection Agency has identified manure injection and subsurface litter application as "next generation" nutrient management practices warranting emphasis under the Chesapeake Bay Program. The technology was transferred to farmers throughout the Mid-Atlantic States through patent and licensing. *Pasture Systems & Watershed Management Research Unit, University Park, PA*

High Throughput System for Cryopreserving Screwworm Embryos



ARS and North Dakota State University Scientist have developed a high throughput system for cryopreserving screwworm embryos. Screwworms are insects that once plagued an 8 billion dollar livestock industry in the southern and southwestern U.S. The insect is an ectoparasite that can seriously harm or even kill any animal that has an untended open wound. Through the use of releasing massive numbers of sexually sterile insects to mate with the endemic population, screwworms were sequentially eradicated from the U.S., Mexico, and finally Central America. A 42 million dollar screwworm mass-rearing facility was recently built in Pacora, Panama for the purpose of maintaining the eradication zone by releasing sterile screwworms along the Panamanian-Columbian border. Establishing a cryobank of screwworm embryos for this facility provides insurance which guards against strain deterioration through genetic drift, and strain loss caused by disease or facility malfunction or shutdown during renovation. During the past year, the high throughput system was tested in Pacora and subsequently two robotic units were installed, one in the factory Methods Development Laboratory and one in the ARS Screwworm Research Laboratory. The units are functioning extremely well as the hatching rate of cryopreserved embryos after storage in liquid nitrogen recently averaged $63 \pm 12\%$. Plans are now being made for the purpose of building and installing a third unit in the screwworm factory located in Tuxtla Gutierrez, Mexico. A patent application is also being formulated for the robotic unit as the system has a potential for use in other areas of cryopreservation where high throughput is desired. The system for cryopreserving screwworm embryos was transferred through a public release. *Red River Valley Agricultural Research Center, Insect Genetics and Biochemistry Research Unit, Fargo, ND*

Cover Crop Chart

Recognizing the need for increased cropping system diversity in the Great Plains, ARS scientists developed a novel decision aid to assist agricultural producers in making cropping decisions that enhance agricultural sustainability. The decision aid, entitled 'Cover Crop Chart' (CCC), includes information on 46 crop species that may be planted individually or in cocktail mixtures to address critical production and/or natural resource issues on working farms. Using an appealing visual aid patterned after the periodic table of elements, the CCC contains specifics on growth cycle, relative water use, plant architecture, forage quality, pollination characteristics, and nutrient cycling for most crop species. Since the public release of version 1.1 of the CCC (June 2010), it has been downloaded more than 1,100 times by users in 18 countries and was featured in *The Furrow* (2010) and *Successful Farming* (2011). The Cover Crop Chart is available at <http://www.ars.usda.gov/Services/docs.htm?docid=20323>. Northern Great Plains Research Laboratory, Mandan, ND

BIOENERGY AND BIOPRODUCTS

- 133 Research Projects
- 29 Locations
- 257 Scientists

Fuel Properties of Biodiesel/Ultra-Low Sulfur Petrodiesel Blends



The influence of blending biodiesel with petrodiesel on overall fuel properties is not well understood. For more widespread distribution of biodiesel into the marketplace and reduced dependence on imported petroleum, such effects must be understood for customer acceptance. Biodiesel made from soybean, palm, rapeseed, and used cooking oils was blended with ultra-low sulfur petrodiesel (maximum sulfur content = 0.0015 mass percent) and tested for cold flow properties, density, viscosity (thickness), and other fuel properties employed to characterize diesel fuels by Bio-Oils Research Unit scientists at the National Center for Agricultural Utilization Research in Peoria, IL. Results were compared with corresponding data for biodiesel in blends with petrodiesel with higher sulfur content (0.05 mass percent). Additionally, calibration curves were developed to analyze volume percent of biodiesel by measuring fuel properties of the blends. Results from this work will contribute to a scientific database on the properties of biodiesel/ ultra-low

sulfur petrodiesel blends, provide useful information to fuel producers, distributors, scientists, and engineers, and promote the use of biodiesel in blends with conventional diesel fuel. *Bioenergy Research Unit, Peoria, IL*

Biodiesel from Alternative Oilseed Feedstocks



Since there is a limited supply of commodity vegetable oils available for producing biodiesel, the search for additional oils or fats that can serve as feedstocks or improvement of current production procedures is critical. Oils that were evaluated by Bio-Oils Research Unit scientists at the National Center for Agricultural Utilization Research in Peoria, IL, for biodiesel applications included anise, aragula, camelina, coriander, cottonseed, cumin, cuphea, field pennycress, hazelnut, jojoba, macadamia, meadowfoam, upland cress, walnut, and wild mustard. Such oils can be used as alternative biodiesel feedstocks that do not displace existing agricultural production. As is the case with biodiesel from other oils, some technical problems exist in terms of properties requiring optimization. Overall, such work will contribute to enhancing the supply of biodiesel and reduce dependence on petroleum-based diesel fuel. This technology will be transferred through scientific publication. *Bioenergy Research Unit, Peoria, IL*

Molecular Mechanisms of Ethanol Tolerance Identified in the Yeast *Saccharomyces cerevisiae*

The yeast *S. cerevisiae* is a superb ethanol producer which has been widely applied in production of biofuel from starch and more recently from lignocellulose hydrolyzates. However, it is sensitive to inhibitors present in hydrolyzates as well as to the ethanol product of fermentation. Applying a newly developed quantitative real time polymerase chain reaction (qRT-PCR) array and a *S. cerevisiae* derivative with tolerance to both ethanol and hydrolyzate inhibitors, Bioenergy Research Unit scientists at the National Center for Agricultural Utilization Research in Peoria, IL, identified important genes, pathways, and regulatory genes responsible for ethanol tolerance. Knowledge of molecular mechanisms of ethanol tolerance resulting from this study will directly aid metabolic engineering efforts for more tolerant yeast development. More stress-tolerant yeast are desirable to rapidly ferment and accumulate high titers of ethanol in inhibitory hydrolyzates, reduce recovery costs, and deliver to consumers low cost biofuel from renewable plant biomass. *Bioenergy Research Unit, Peoria, IL*



Biological/Electrochemical Conversion of Biomass to Hydrocarbons Fuels

Conversion of cellulosic biomass to ethanol in a single reactor (consolidated bioprocessing [CBP]) has numerous advantages over simultaneous saccharification and fermentation (SSF), but both processes share requirements for substrate pretreatment, contamination control, and an inability to convert noncarbohydrate components. ARS scientists have combined the in vitro fermentation of biomass materials to volatile fatty acids (VFA) by mixed ruminal bacteria with a subsequent electrolysis of the



VFA to produce mixtures of hydrocarbons useful as fuels, along with hydrogen gas. The fermentation can be performed on ground biomass without additional pretreatment and without sterilization of the biomass or the culture medium. The electrolysis can be conducted at low voltages with inexpensive graphite electrodes. A U.S. patent application has been filed, and commercial partners are being sought to assist with scale-up and development. Successful development of this technology will produce hydrocarbon fuels and valuable co-products from mixed biomass feedstocks with minimal preprocessing. *U.S. Dairy Forage Research Center, Madison, WI*

A Method for Measuring Emission or Gaseous Concentration of Ammonia



While the traditional acid trap method for measuring emission or gaseous concentration of ammonia relies on mineral acids, this new technology uses a triprotic organic acid. Citric acid is an ideal acid to be used for this method—because it gives up three protons in solution, it is able to buffer over a wide pH range. Therefore, the relationship between solution pH and captured ammonia is nearly linear over much of the measurement range, resulting in a nearly constant sensitivity. Additionally, the nearly linear response minimizes the effect of errors in pH measurement or within the speciation model that is incorporated into the algorithm. This new method will provide researchers with a rapid, easy, and inexpensive approach for measuring ammonia concentrations in barns and around other ammonia sources, and for measuring ammonia emission from agricultural sources. The sensitivity and capacity of the method can be adjusted by varying the citric acid concentration of the solution, and so the method can be applied to a wide range of emission rates or concentrations. This technology was transferred through a publication. *The Pasture Systems & Watershed Management Research Unit, Beltsville, MD*

New Sophoroses and C-Glycoside-Based Biosurfactants as Agricultural Co-Products



Microbial biosurfactants are of increasing interest for use in environmentally benign cleaning or emulsifying agents, and as potential replacements for petroleum-based detergents. ARS has developed a rapid spectrometric screen for several types of biosurfactants, including sophorolipids from recently-identified yeast in the USDA-ARS collection in Peoria, IL. Unlike those reported previously, these new *Candida* spp. NRRL Y-27208 sophorolipids contain a ω -hydroxy-linked acyl group (typically 18-hydroxy- Δ^9 -octadecenoate), and occur mainly in a non-lactone, anionic form. Seventeen different sophorolipid dimers and trimers were also identified from this new strain. The scientists have also developed green chemistry processes for producing new detergent materials starting from sugar C-glycosides and a plant glycerolipid, such as corn or canola oils. Depending on the starting materials the detergent properties of these acyl-C-glycosides can be tailored to specific needs, from low-foaming dishwasher applications, to high foam personal care products. The high yield, competitive cost, and surfactant-like properties of these new materials has considerable value as renewable, green replacements for petroleum-based detergents and emulsifiers. This technology will be transferred through patent and licensing. *The Renewable Product Technology Research Unit, Peoria, IL*

SUSTAINED FOOD PRODUCTION

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

Estimating Forage Intake By Beef Cattle



Hardware and software to classify ingestive events and estimate intake in grazing beef cattle was developed by ARS scientists and has the capacity to record and classify grazing events for up to 5 hours. This system is first to solve the previously intractable problem of estimating forage intake directly. The estimates demonstrate a high degree of precision and are relatively inexpensive to make. This technology was transferred by public release. *Appalachian Farming Systems Research Center Beaver, WV*

Short-Term Field Studies Are Not Sufficient to Develop Recommendations

Stockpiling tall fescue is a popular technique to increase forage availability to grazing livestock during winter months. A study was conducted by ARS scientists to evaluate the impact of one application or split applications of N rates (0, 40, 80, 120 lbs/A) on fescue yield and quality. Sixty years of historical weather data were used to model mean temperature and rainfall for August-November. The historical data showed that the weather during the years that the study was conducted was atypical of the historical data. These data show that short term studies need to be interpreted within the historical context to provide recommendations that take into account the risks associated with management decisions. These data demonstrate that field recommendations can be very unreliable even when they are based upon relatively large data sets over many years. Field data interpretations are far more robust when they are subjected to historical environmental context. This information released through publication. *Appalachian Farming Systems Research Center Beaver, WV*



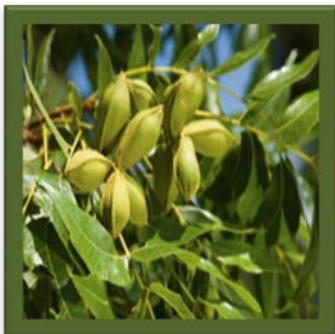
Seed Treatment to Enhance Yield Under Water Limiting Conditions



ARS scientists have developed a seed-seedling treatment that enhances cotton yields 5 to 20% under water limiting conditions. Yield enhancements in cotton have been obtained annually in three years of field trials. Preliminary results have also shown a 10% yield increase in chili peppers using this yield enhancement technology. This technology may have broad application to many crops grown under water limiting conditions. It will help to overcome environmental and genetic limitations of cotton yields by enhancing the rate of cotton production within existing cotton varieties.

Application is effective to elicit one or more effects in the resultant plant including reduced apical dominance, increased rate of development of fruiting branches, decreased time to first bloom, increased number of cotton squares formed, thickening of the hypocotyl, reduced rate of leaf wilting, reduced water usage, and increased root development. This technology will be transferred through patent protection and licensing. *Cropping Systems Research Laboratory, Lubbock, TX*

'Lipan, a New Pecan Cultivar'



'Lipan' is a new pecan cultivar released by the USDA ARS National Pecan Breeding program. It has high nut quality, high yield potential, medium early nut maturity, and excellent scab disease resistance. 'Lipan' is regular in its yield, increasing production with age with little alternate bearing. This cultivar should be adapted to all pecan growing regions of the world, except the extreme northern US. Another variety released by the Crop Germplasm Research Unit to support the pecan growers in the United States. 75% off all pecans produced in the United States are from pecan lines developed by this program. This technology was transferred by public release of the variety. *Crop Germplasm Research Unit, College Station, TX*

Development of 'Mace' Virus Resistant Hard Red Winter Wheat



USDA-ARS scientists at Lincoln, NE, led an international team that developed and released 'Mace', the world's first wheat cultivar that carries resistance to both Wheat Streak mosaic virus, and a newly discovered associated virus, Triticum mosaic virus. The first commercial sales of Mace seed occurred in time for fall 2011 planting, and wheat producers in Texas, Oklahoma and Nebraska will harvest their first crops of Mace in 2012. Biological control of viruses through release of resistant cultivars is an important aspect of sustainable agricultural systems. Previously, the only available means of control was to kill the wheat curl mite, the vector of both viruses, with pesticides. This technology was transferred by PVP and licensing. *Limagrain Cereal Seeds, Wichita, KS*

Identification and Utilization of Ug99 Resistance Genes from Wild Relatives of Wheat



Stem rust is a devastating disease. In a major epidemic in 1953 and 1954, stem rust caused \$365 million in losses in the U.S. wheat crop, including destruction of more than 75% of the durum wheat crop (the source of pasta). The destructive potential of this disease is so great that the former Soviet Union explored its use for bio-warfare. Currently, a relatively new strain (Ug99) and its variants beginning to spread around the world's wheat growing regions has struck fear in

governments around the world because most wheat is susceptible to the new strain and its variants. The Bill & Melinda Gates Foundation donated millions of dollars for a grant program administered through Cornell University toward the global fight against Ug99. Dr. Steven Xu (ARS) has developed a procedure to introgress resistance into wheat from its wild relatives that can accomplish in 3 years what other researchers have not accomplished in 30 years (literally!). He has already used this procedure to introgress several different resistance genes (all effective against Ug99) into wheat so that these genes can now be used by plant breeders. In the past year, seed has been distributed by request to a number of public and private wheat breeders eager to use the new resistance. This technology was transferred through public release of the germplasm. *Red River Valley Agricultural Research Center, Cereal Crops Research Unit, Fargo, ND*

Next-Generation Broad-Spectrum Insecticide



Marrone Bio Innovations (MBI), a leading global provider of natural products for the agricultural and water treatment markets, announced that the Environmental Protection Agency has approved its latest product, MBI-203 EP, which will be branded as Grandevo™. It is a broad-spectrum, high-performance natural insecticide for use on agricultural and ornamental crops. MBI-203 is initially being launched in Florida for insects such as citrus psyllid, following its approval from the Florida Department of Agriculture and Consumer Services. MBI intends to launch Grandevo nationally in 2012, and to market the product to growers and pest control advisors through its existing distribution channels.

“Grandevo represents a significant achievement for MBI, they now provide both fungicide and insecticide solutions. Field trials conducted by leading universities and crop consultants have shown Grandevo has equivalent or better performance to chemical pesticides. Not only does this product address a broad spectrum of insects (both chewing and sucking species), but its complex mode of action – ingestion, contact and repellency – makes it more difficult for insects to develop resistance versus the single-site products predominantly used today. “Grandevo is the first new microbial insecticide offered in nearly 50 years. Grandevo is derived from a new species of *Chromobacterium*, named *subtsugae*. When unwanted insects encounter Grandevo, they become highly agitated and try to remove the product from their bodies. When it is ingested, the targeted insects will stop feeding and die. Grandevo is well suited for rotation in pest management programs to help prolong the efficacy of conventional pesticides and manage chemical residues. It can be used for managing psyllids, thrips, mealybugs, leaf miners, stinkbugs, Lygus, leaf beetles, white grubs and armyworms. Grandevo requires no pre-harvest interval and has minimum re-entry intervals, enabling crops to be harvested soon after application. Its exemption from the requirement of a food tolerance is particularly important for exported crops that are subject to maximum residue levels. Also, the product is compliant with the National Organic Program (NOP) and listed by the Organic Materials Review Institute (OMRI). Grandevo can be used in field, greenhouse and garden markets. The strain coded PRAA4-1T was originally discovered by USDA scientist Dr. Phyllis Martin, and licensed to MBI. *Invasive Insect Biocontrol and Behavioral Laboratory Beltsville, MD*

Disruption of Insect Diapause using Agonists and an Antagonist of Diapause Hormone

Corn earworm is considered by some to be the most costly crop pest in North America. They often attack the valuable harvestable portion of the crop such as blossoms, buds, and fruits. On corn, its most common host, they tend to feed on silks initially, and interfere with pollination, but eventually they move to the corn kernels. Such feeding enhances development of plant pathogenic fungi. The corn earworms, are also known as the tomato fruitworm and the cotton bollworm and feed on a number of crops including green beans, clover, vetch, lettuce, peppers, soybeans and sorghum. Researchers at the ARS Southern Plains Agricultural Research Center, and researchers at Ohio State University, have developed compounds that disrupt diapause (a 'sleep time') that is different from hibernation in corn earworms. The ability to block diapause or prompt an insect to come out of it early, when food is scarce, would be an environmentally friendly pest control. While a commercial product may be years away, researchers are optimistic that controlling an insect with a treatment developed from one of its hormones will one day be used to combat corn earworms and other agricultural pests. Corn earworms are the number one pest of corn worldwide. They are a great concern to American agriculture and potentially cause billions of dollars of economic loss to crops. Losses, due to the corn earworm in field corn have been estimated at 2.5% annually. Losses in sweet corn may be as high as 50%.
Areawide Pest Management Research Unit, College Station, TX



Engineering Plant Resistance Against Downy Mildew



Hyaloperonospora parasitica belongs to a group of ~ 800 fungal plant pathogens that cause Downy mildew, an economically important disease affecting numerous plant species. Resistance or (R)-gene-mediated defense is the principal immune mechanism in higher plants providing protection against these obligate pathogens. It has been proposed that R-gene mediated defense and broad-spectrum basal defense in plants overlap. However, the underlying molecular mechanism is largely unknown. ARS has identified of 22 novel genes involved in R-gene-mediated resistance against downy mildew in *Arabidopsis thaliana* and their regulatory control by the circadian regulator, CIRCADIAN CLOCK-ASSOCIATED 1 (CCA1). Numerical clustering analysis based on disease phenotypes of these 22 gene mutants revealed that programmed cell death (PCD) is the major contributor to disease resistance. Mutants compromised in the R-gene-mediated PCD were also defective in basal resistance, establishing an interconnection between these two distinct defense mechanisms in higher plants. Through a combination of promoter analysis and RASL-Sequencing analysis (RNA Annealing, Selection and Ligation), ARS showed that these newly identified defense genes are under circadian control by CCA1, allowing plants to 'anticipate' infection at dawn when the pathogen normally disperses its spores and to 'time' endogenous immune responses based on the perception of different pathogenic signals following infection. Analyzing temporal control of the defense genes by CCA1 allowed us to differentiate their involvement in basal and R-gene-mediated defense. This research has, for the first time, revealed that a plant's defense system cycles on a daily basis, even when pathogens are absent, and provided 22 defense candidate genes for engineering plant

resistance against downy mildew with obvious potential benefits to hundreds of agricultural and horticultural plant species. *The Crop Systems and Global Change Laboratory, Beltsville, MD*

A Diagnostic Tool for Six (6) Viroids That Infect Pome and Stone Fruit Trees



Viroids are plant pathogens (small RNA particles which infect plants). Viroids were discovered and given their name by Theodor Diener, a plant pathologist at the Agricultural Research Service in Maryland, in 1971, considered a major breakthrough in 20th century. ARS researchers now have developed Material consisting of sequentially cloned fragments (cRNA) that bind specifically to the RNA genetic material of six (6) viroids that infect pome and stone fruit trees, along with several other crops. The viroids are: apple scar skin (ASSVd), apple dimple fruit (ADFVd), apple fruit crinkle (AFCVd), hop stunt (HSVd), pear blister canker (PBCVd), and peach latent mosaic (PLMVd) viroids. Material is useful as cost effective, rapid, and reliable diagnostic tools for these viroids by plant germplasm certification and quarantine programs. Material has also generated interest from plant pathogen commercial diagnostic companies as a possible service testing tool and/or for potential to be adapted to a diagnostic kit format. The material was transferred for testing by an industry partner by two Material Transfer Agreements and has now been licensed by that partner. *The National Germplasm Resources Laboratory, Beltsville, MD*

Deregulation of 'HoneySweet' Plum Genetically Engineered for Resistance to Plum Pox Virus (PPV)



An ARS research resulted in the approval of 'HoneySweet', a genetically engineered (GE) plant, for cultivation and consumption in the U.S. This is only the second genetically engineered fruit crop and the first genetically engineered temperate zone woody perennial to receive full regulatory approval in the U.S. that included reviews and approvals by APHIS, FDA, and EPA. This effort required substantial research, human and material resources to develop dossiers that not only demonstrated PPV resistance and horticultural benefits of 'HoneySweet' but also provided reliable background scientific information for risk assessments, including studies of transgene flow, the environmental safety and stability of the high level of PPV resistance, and the safety of fruit for human consumption. Among the other objectives, the work involved sequencing and assembling, for the first time ever, the entire plum genome. This is a significant scientific accomplishment in its own right. The plum genome sequence represents one of the few tree fruit genomes that have been sequenced to date. The research associated with deregulation required setting up a vast international network of collaborations with scientists, especially in Europe, to field test the resistance of 'HoneySweet' to PPV because the disease is quarantined in the U.S. The uniqueness of this accomplishment stems from the fact that it is the first time ever that a deregulation of a GE plant was petitioned by a government institution. With 'HoneySweet' the U.S. now has plum germplasm highly resistant to PPV that is available to breeders and growers for the protection of U.S. plum production. This technology was transferred through patenting and licensing. *The Appalachian Fruit Research Station, Kearneysville, WV*

Development of Control Technologies for the Brown Marmorated Stink Bug (BMSB)



Based on the well-documented need from stakeholders for a reliable monitoring tool for Brown Marmorated Stink Bug (BMSB), *Halyomorpha halys* (Stål), an ARS researcher has significantly expanded research efforts into development of a trap-based monitoring system for BMSB, which is expected to be critical for developing behaviorally based management strategies such as ‘attract and kill’ technology. Moreover, monitoring tools are used to assess the presence, abundance, and seasonal activity of pests and natural enemies to determine the need for and timing of insecticide applications. Currently, there is no effective monitoring system to effectively and reliably detect BMSB in any cropping system. In addition, ARS NAA partnered with ARS-Beltsville and Virginia Tech to identify the aggregation pheromone and other potential attractants for BMSB and to utilize these olfactory stimuli as lures or baits. As more is learned about the biology and behavior of BMSB, a rational deployment strategy will be developed. In addition, ARS plans to partner with many land grant universities including Virginia Tech, Penn State, University of Maryland, University of Delaware, Rutgers, Cornell, Oregon State, NC State and Washington State based on a recently funded SCRI grant totaling \$ 5.7 million over 3 years, led by the Appalachian Fruit Research Station. The impact of this work is tremendous. BMSB is an invasive insect native to China, Taiwan, Korea, and Japan that has emerged as a pest of nearly unprecedented importance to agriculture in the United States. This technology will be transferred through patent and licensing. *The Appalachian Fruit Research Station, Kearneysville, WV*

Plant Virus Used to Make Animal Vaccine



Weakened or killed viruses used to make animal vaccines are currently made using animal cells, such as making flu vaccine using chicken eggs. ARS scientists developed a way to make an animal vaccine in a plant using the plant virus Cucumber mosaic virus (CMV). Part of the protein coat of Avian influenza virus (HPAIV) was inserted into CMV. Another plant virus, potato virus X, was used with the modified CMV to cause the plant to make a protein. When this protein was purified from the plant and injected into chickens, the chicken developed an immune response to HPAIV, indicating that it acted like a vaccine. This research also developed a method to use plant viruses to assemble sub-microscopic, spherical protein “cages” that can be used to develop extremely sensitive diagnostic tools to detect plant and animal pathogens. These techniques can be used to improve production of vaccines and other proteins. This technology will be transferred through Scientific publication. *Molecular Plant Pathology Laboratory, Beltsville, MD*

A Broccoli Gene That Impacts Nutritional Content in Vegetable Crops



Selenium is an essential trace mineral. Both biosynthesis and volatilization of selenium compounds affect the accumulation of the bioactive forms of selenium in crop plants. Broccoli accumulates high level of bioactive forms of selenium. To reduce selenium volatilization for producing healthy and more nutritious crops, ARS scientists isolated a novel broccoli gene whose product mediates selenium volatilization, and utilized this knowledge to manipulate the nutritional value of crops via reduced nutrient loss due to natural volatilization. The discovery opens up new avenues toward increasing the accumulation of bioactive compounds in plants. This technology will be transferred through scientific publication. *Plant, Soil and Nutrition Research, Ithaca, NY*

Integrating the Soybean Genome Sequence With the Soybean Genetic Map and Developing an Encyclopedia of Soybean Gene Messages

The complete DNA sequence for the soybean genome produced by ARS scientists together with university and Department of Energy collaborators, was released. It is one of the largest and most complex genomes sequenced to date. To take full advantage of this important new resource for soybean improvement, ARS scientists incorporated the sequence information into SoyBase and the Soybean Breeders Toolbox, the USDA's soybean genetics and genomics database. SoyBase now includes extensive 'under-the-hood' links to 30 years of data for many high-value traits, including seed yield, seed quality and disease susceptibility, biochemical pathways, and tens of thousands of new DNA marker sequences and genes, as well as powerful, new visualization tools for the soybean genetic and physical maps and the soybean genome sequence. SoyBase now will enable plant breeders to comprehend the genetic control and function of genes that govern critical agronomic traits. This technology was transferred through a public release. *Ames, Iowa, and Beltsville, MD*



Germplasm Release of Rainbow Trout



ARS researchers announce the release of the ARS-Fp-R (YC2012) line of rainbow trout (*Oncorhynchus mykiss*) that have been selected for improved survival following laboratory challenge with *Flavobacterium psychrophilum*, the bacterium that causes bacterial cold water disease (BCWD). A limited quantity of eyed eggs from the ARS-Fp-R line will be available in February and March of 2012 to producers with documented broodstock programs that are interested in propagating and/or introgressing the line. *Orono, ME*

FOOD SAFETY AND NUTRITION

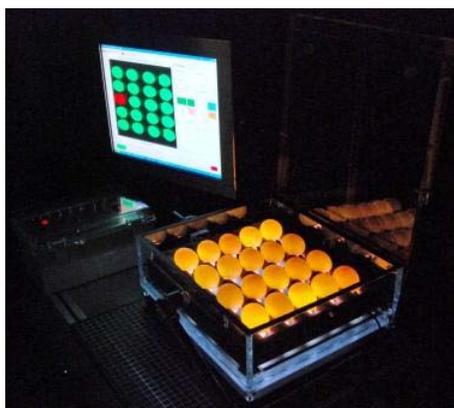
- 115 Research Projects
- 25 Locations
- 300 Scientists

Flash Pasteurization, Food Safety and Intervention Technologies



Flash Pasteurization uses bursts of steam to inactivate microorganisms on the surfaces of raw and processed meats products immediately prior to packaging. Flash Pasteurization is derived from the Vacuum-Steam-Vacuum process invented at the ARS's Eastern Regional Research Center. The Flash Pasteurization technology was developed as part of a Cooperative Research and Development Agreement (CRADA) between ARS and industry partner. Flash Pasteurization, used in combination with GRAS antimicrobials, has now been commercialized for the decontamination of frankfurters and over \$1 billion of product has been treated by the process in North, Central, and South America. For this work, the engineers and scientists involved won the ARS Outstanding Technology Transfer Award for 2008 (top honor) as well as the 2011 Federal Laboratory Consortium Excellence in Technology Transfer Award. *Food Safety and Intervention Technologies Research Unit, Wyndmoor, PA*

Egg Micro-Crack Detection System



To detect checks and/or cracks in shell eggs, the egg industry is using high-speed acoustic systems. Once the eggs are processed and checked or cracked eggs are removed, the remaining eggs are boxed for sale. Prior to shipment, human graders sample a small subset of eggs to ensure that the high speed systems are operating within specifications for a given grade of egg (i.e. Grade A Large Eggs). Currently these government graders use a longstanding technique of visually candling and audibly “belling” an egg to detect defects such as cracks or checks. Belling an egg is a technique where two eggs are gently tapped together to listen for a dull sound which usually is an indication of a check or crack. Once heard, the grader then visually confirms there is a crack. However, with some processing lines, very small egg cracks, known as micro-cracks, are frequent, and can initially go undetected by the human graders. Thus, there is a need for a batch system to assist the graders in detecting the micro-cracks and validating the grade of an egg. ARS researchers a system to identify micro-cracks, cracks, and checks in eggshells. The technology uses a special vacuum pump, vacuum egg chamber with back-light illumination, digital camera, control circuit, and computer to enhance the detection of cracks in eggshells. The technology is capable of processing multiple eggs at time and uses rollers to turn the egg in the chamber so the entire egg can be examined. Image processing software takes a negative pressure image and divides it by an atmospheric pressure image to enhance the crack feature. Additional processing of the image includes masking the background, using a simple threshold, and a

morphological filter to remove noise. The results are displayed on the computer screen and saved for record keeping. Cracks are shown and eggs are color-coded for easy identification. This technology will be transferred through the patent and licensing. *Quality & Safety Assessment Research Unit, Athens, GA*

Study Shows Polybrominated Diphenyl Ether (PBDE) Levels in the US Meat Supply Have Decreased



An ARS researcher measured the concentrations of newly recognized class of environmental pollutants, the polybrominated diphenyl ether (PBDE) flame retardants, in beef, pork, and poultry tissues collected in 2002 and 2008. The study was a collaborative effort between the USDA's Food Safety and Inspection Service (FSIS) and the Agricultural Research Service. ARS demonstrated that PBDE levels in the US meat supply have decreased, most likely as a result of recent voluntary restrictions on the production of PBDEs in the US.

PBDEs are chemical flame retardants that have been used widely in industrial and consumer products during the last several decades. Because of their resistance to chemical and biological degradation, PBDEs are ubiquitous in the environment and in the food supply. Human exposures occur through dietary and environmental pathways, but the diet is considered the major source of PBDE exposure for most Americans. In fact, several studies have indicated that PBDEs present in the US food supply are greater than those of other developed countries. As a result, the manufacturing and use of several PBDE formulations has been restricted or eliminated during the last decade in an effort to reduce human exposures. This study has demonstrated that PBDE levels in the US meat supply diminished significantly during the survey period (2002 to 2008) and that PBDE residues are as low as the levels in other developed countries. With regards to PBDEs, the study clearly demonstrates that the US meat supply is safe for consumers and is suitable for export markets. This research study was transferred to industry and the public by a public release. *Red River Valley Agricultural Research Center Animal Metabolism-Agricultural Chemicals Research Unit, Fargo, ND*

DNA Targets for Escherichia coli Serotypes



In an attempt to provide safer meat products, researchers have developed DNA targets that discriminate Shiga toxin containing *Escherichia coli* serotypes O26, O45, O103, O111, O121, and O145 from other bacteria. Almost all assays to detect Shiga-toxigenic *E. coli* (STEC) non-O157 serotypes use PCR primers that amplify bacteria of the same serotype regardless if they have Shiga toxins or virulence factors which results in a sample being false positive. The current invention targets DNA that is unique to six STEC non-O157 serotypes that can be exploited by PCR to identify these potential human pathogens. The targeted DNA from serotypes O26, O45, O103, O111, O121, and O145 can identify each of the serotypes and associated virulence genes. As a result, these DNA

targets can be used in complex samples. Lack of acceptable testing methodology for non-O157 STEC has prevented FSIS from implementing testing procedures to determine if ground beef samples and trim

are contaminated with a pathogenic non-O157 STEC. The advantage over what is currently state of the art is the added specificity of the nucleotide polymorphisms. The nucleotide polymorphisms are specific to strains within each serotype that are more likely to cause human disease. This technology will allow meat producers to test for these pathogens quickly and economically. This technology will be transferred through patent protection and licensing. Currently two companies have applied for non-exclusive licenses. *Roman L. Hruska U.S. Meat Animal Research Center, Clay Center, NE*

Bacteriophage as a Biocontrol Agent Against Non-O157 Shiga Toxin-Producing *E. coli*

Currently the U.S. tests ground beef for one strain of *E. coli*, O157:H7. The USDA has proposed a new regulation to test for six other dangerous strains, which are the cause for over 70% of non-O157 STEC disease. ARS researchers have developed bacteriophage as a biocontrol agent against non-O157 shiga toxin-producing *E. coli*. They have isolated and characterized bacteriophage with lytic activity against the top six non-O157 serotypes including: O26, O45, O103, O111, O121, and O145. Non-O157 STEC serogroups may be present in cattle, beef trimmings, ground beef, and on beef carcasses as well as non-beef food sources. These bacteriophages can be used as a pre-



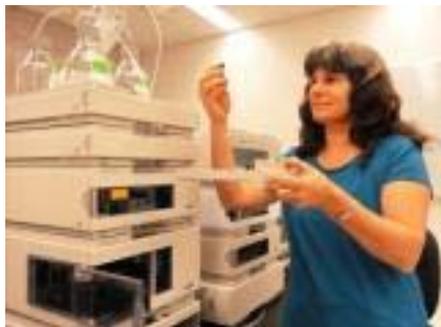
harvest antimicrobial intervention against STEC contamination of cattle. The phage can also be given to cattle through feed to reduce the prevalence and levels of non-O157 shed in cattle feces, or applied directly to raw beef products. USDA's Food Safety and Inspection Service (FSIS) will launch a testing program to detect these dangerous pathogens and prevent them from reaching consumers. This technology will be transferred through patent protection and licensing. *Roman L. Hruska U.S. Meat Animal Research Center, Clay Center, NE*

Testing and Screening For Non-O157 Shiga Toxin-Producing *Escherichia coli* (STEC)



ARS, USDA Food Safety and Inspection Service (FSIS) and additional collaborators at Penn State led the studies that resulted in the development of a novel method to detect the top six non-O157, Shiga toxin-producing *E. coli* (STEC). Using this new technology, the FSIS will start testing beef for the presence of non-O157 STEC serogroups beginning March 2012. Not only does the method allow detection and isolation of the non-O157 STEC serogroups but also O157:H7 STEC from the same beef sample. Prior to this development, there were no assays that could detect these specific six serogroups plus *E. coli* O157:H7 in one system. Non-O157 STEC can cause hemorrhagic colitis and hemolytic uremic syndrome and deaths in humans in a way similar to that caused by *E. coli* O157:H7. The method and related papers have been extensively published in the peer-reviewed literature and adopted by the FSIS by including it in their Microbiology Laboratory Guidebook. *The Molecular Characterization of Foodborne Pathogens Management Unit, Wyndmoor, PA*

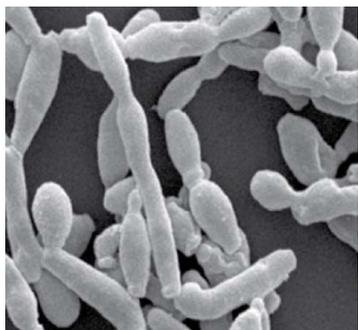
Testing and Screening For Veterinary Drug Residues



ARS researchers developed, extensively validated, and transferred to FSIS a pair of advanced methods with fast sample throughput and much better performance to screen and identify 67 priority veterinary drug residues in meat samples. The new approach uses rapid extraction followed by ultrahigh performance liquid chromatography – tandem mass spectrometry to cover the existing drugs monitored below regulatory tolerance levels, and also expands the range to include many priority drug residues previously missed. FSIS is in the process of implementing the new approach, which is the central innovation leading FSIS officials to devise a more efficient and effective overall National Residue Program for residue monitoring and regulatory actions. This development is a major improvement over the FSIS’s currently used combination of three inefficient screening tests, which are capable of only determining classes of drugs responsible for positive drug residue results. Use of the developed methods will ensure that every food animal is properly screened to possibly contain veterinary drug residues in thousands of slaughter establishments across the USA. Such screening will protect the public from exposure to potentially harmful residues. This research was conducted and published under the ARS food safety Detection and Validation Project *Residue Chemistry and Predictive Microbiology Unit, Wyndmoor, PA.*

DOWNSTREAM OUTCOMES FROM FS TECHNOLOGY TRANSFER ACTIVITIES

Xylose Fermenting Yeast



In the United States, there is considerable interest in developing alternative energy sources to reduce dependence on foreign oil and nonrenewable energy. The use of ethanol as a fuel has become increasingly prevalent in recent years. Biomass can be used to produce ethanol, but the high concentrations of xylose in biomass make metabolization into ethanol inefficient and not economically feasible. Thus, new yeast strains developed by USDA Forest Products Laboratory (FPL) and the methods to use them are needed to develop a more efficient means of bioethanol production. A clean technology company serving the global biofuels industry has licensed a yeast technology that was co-developed by researchers from the USDA Forest Service and the University of Wisconsin – Madison. This technology is associated with the fermentation of C5 sugars, such as xylose to ethanol. The license marks the culmination of several Cooperative Research and Development Agreements (CRADA). *Forest Products Lab (FPL), Madison, WI*

Surface Area of Fasteners



Accurate identification of the surface area of threaded fasteners is essential for understanding the limitations of fasteners in numerous applications, including the corrosion rate for fasteners exposed to treated wood. Following the voluntary withdrawal of CCA (chromated copper arsenate) from residential use, alkaline wood preservatives, such as ACQ (alkaline copper quarternary) and CuAz (alkaline copper azole), are being increasingly used. These new alkaline-based preservatives are more corrosive than CCA, but up until now no accurate means to calculate corrosion rates existed. This invention is a method and apparatus for the determination of a surface area of a fastener, such as a threaded fastener.

Specifically, an image of the fastener is acquired, the image is separated into at least two regions and the surface area of each region is determined. The surface areas determined for each region are summed to determine the surface area of the fastener, which allows the corrosion rate to be calculated. An accurate determination of the corrosion rate helps determine the effectiveness of a fastener. The Forest Service holds a patent on this technology and is currently looking for licensees. Named one of “Fastener Technology International’s” top new products for 2011.

Forest Products Lab (FPL), Madison, WI

Walnut Twig Beetle



Walnut tree species (*Juglans regia*) and (*Juglans nigra*) are two highly valuable forest resources. However, these species are threatened by the Thousand Cankers Disease. Walnut twig beetles (*Pityophthorus juglandis*) cause this disease by carrying spores of the fungus *Geosmithia morbida*, which infect the trees. The chemical mixture in this invention is a combination of pheromones produced by walnut tree beetles and walnut trees. Combinations of these semiochemicals can detect, attract, or repel the walnut tree beetle as necessary, providing a means to prevent thousand cankers disease, and also to monitor and control walnut tree beetle populations. This technology is primarily useful for protecting nut orchards, native and adventive timber stands and ornamental trees. Use of semiochemicals for trapping, monitoring and manipulation of reproductive behavior of *P. juglandis* will aid in reduction of walnut tree mortality due to *Geosmithia morbida* infection (Thousand Cankers Disease). As such, it is a valuable resource to private and public entities, both on a small scale and for the walnut tree industries as a whole. The Forest Service recently filed a patent application on this technology and is engaged in preliminary licensing discussions with a commercial company. *Pacific Southwest Research Station, Vallejo, CA*

Recycled Fiber/Agricultural Fiber Panels



Panels made of recycled fiber and based on FPL research are being commercialized.

Researchers at Forest Products Laboratory (FPL) have developed panels made from forest residuals, recycled fiber, and agricultural by-products. This fundamental and applied research is being successfully transferred to two industrial partners who are developing panel products that use the technology. One company is creating a line of furniture and structurally insulated panels. The other company is focusing on furniture, office partitions, and architectural materials panels. All raw panels made at FPL are naturally bonded and formaldehyde free. FPL is continuing to help these companies with technology transfer issues so that they can be in production in the near future and license negotiations are underway. *Forest Products Lab (FPL), Madison, WI*

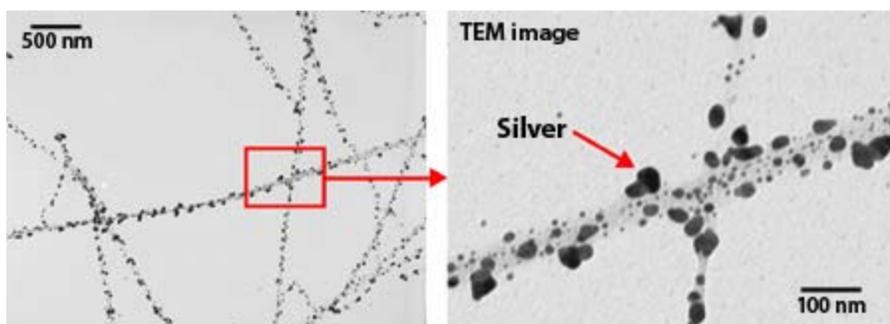
America's Historic Covered Timber Bridges



Portland Mills Covered Bridge in Parke County, IN with a Burr-Arch truss design.

Covered wooden bridges proliferated in the United States in the mid-nineteenth century. Today an estimated 800 covered bridge structures remain as cherished links to the technological heritage of the US. The through-truss designs vary from the Kingpost trusses built in the craft tradition to the engineered Burr arch and Paddleford trusses. Covered bridges are links to the past and the pioneering bridge-building efforts and, as such, are considered important early American transportation structures to preserve for posterity. Partnering with the Federal Highway Administration and National Park Service, the Forest Products Laboratory (FPL) has taken the lead in conducting research efforts aimed at preserving and/or restoring historic covered bridges. Several collaborative studies have been initiated to improve engineering evaluation methods, increase the durability of the bridge components, and develop new historic structure documentation techniques. Technology transfer efforts have included K-12 educational modules, historical videos, and technical conferences. *Forest Products Lab (FPL), Madison, WI*

Cellulose Nanocrystals- Novel Templates for the Synthesis of Nanostructures



Transmission electron microscopy (TEM) images of the formation of silver nanoparticles on the surface of tunicate CNCs.

Harvesting the properties of widely available natural biopolymers for the design of novel systems in nanobiotechnology has been largely ignored in favor of other biological molecules, such as proteins, viruses, or DNA. A joint research effort between Forest Products Laboratory (FPL) and Purdue University has shown that cellulose nanocrystals (CNC) have the capacity to assist in the synthesis of metallic and semiconducting nanoparticle chains. Silver, gold, copper, platinum, cadmium sulfide, and zinc sulfide nanoparticles were synthesized on CNCs and the nanoparticle density and particle size could be controlled. CNCs are rod-like reinforcement material that can be extracted from trees, plants and some sea animals (sea squirts). This new technology has potential benefit to a variety of cellulose based industries (paper, packaging, textile, etc) and has potential applications for sensors, catalysts, antimicrobial materials, current carrying and energy storage capabilities. *Forest Products Lab (FPL), Madison, WI*

Colony Collapse of Eastern Subterranean Termites- Rapid Suppression and Elimination of Termite Colonies

Termites are typically eliminated by treating one house at a time. Community-wide termite elimination strategies are being developed using a method called trap, treat and release and dual baiting stations. In this method, termites are lured to cellulose or cardboard baiting stations (trap), dusted with commercial and/or experimental termiticides (treat), and released back into the colony (release). In laboratory and field tests, researchers observed five characteristic changes in termite colonies on the verge of collapse after the trap, treat and release method using dual treatments: 1) increased numbers of soldier termites, 2) decreased numbers of worker termites, 3) increased numbers of reproductive termites captured in commercial bait stations, 4) susceptibility to mite infestations, and 5) growth of bacteria, fungi and slime



molds within the colony. Colony decline and collapse occurred in both laboratory and field tests. Termite toxicants used in combination with a patented termite bait developed at Forest Products Laboratory (FPL), with researchers from FPL and Agricultural Research Service (ARS), accelerated colony decline compared to termite toxicants used alone, especially with the trap, treat and release method. *Forest Products Lab (FPL), Madison, WI*

Bacterial infection in termites experiencing colony collapse. The red coloration in the termite's head is from a colored pigment produced by the bacteria.

Reducing the Impact of Wildfires



Building and landscaping decisions can reduce impacts of encroaching wildland fires and still be aesthetically pleasing. (Photo courtesy of Doug Shick)

Forest Products Laboratory researchers are developing a fire growth model for homeowner-sized plots. This model will help users make decisions concerning building and landscaping that result in reduced impacts of encroaching wildland fires while still being aesthetically pleasing.

Current recommendations of 200 feet of vegetation clearance (and greater if upslope from a fire threat) and of noncombustible building construction is not an attractive option for many homeowners. It is possible to allow combustible objects of limited flammability impact, such as fire-retardant treated siding materials and strategic selection and placement of ornamental vegetation, even under the most severe wild land fire exposure. Complementing the existing recommendations for managing buildings and landscapes to reduce their fire hazards, a fire growth computer model adds managing flexibility to direct attention to lower costs and better aesthetics with a further reduction of fire hazards. It can give

the user a visual indication of why and how the fire mitigation can be achieved, even if certain building and landscape objects are ignited due to severe wildland fire exposures. The fundamental elements of the fire growth model are being developed with state-of-the-art fire testing of realistic objects, using a modified cone calorimeter and large scale heat release rate facility in conjunction with advanced mathematical solutions that allow modeling on a personal computer. Private landowners of ponderosa pine forests in eastern Oregon are being encouraged to reduce wildfire risk on their property. It has been reported that 75 percent of surveyed forest owners have treated some portion of their land between 2003 and 2008. Owners also indicated that they lacked sufficient resources to offset the costs of hazardous fuel reduction, and that they would benefit from cost share funds and markets for logs and wood products generated through thinning. Scientists from Pacific Southwest Research Station developed a remote-sensing based model that produces heat flux estimates that are highly consistent with in situ fire plume measurements. Because carbon flux from the fires was strongly correlated with heat flux measurements, the rate of fuel consumption by the entire flaming front of a large fire can be estimated from fire temperatures estimated from remotely-sensed short- and mid-wave infrared. This model is expected to have wide application for understanding the behavior and environmental effects of wildland fires. *Forest Products Lab (FPL), Madison, WI*

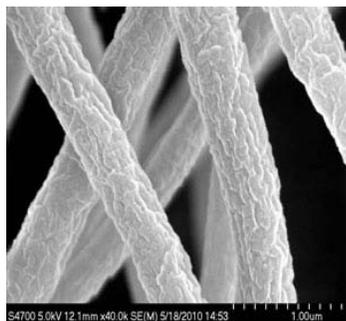
Moisture Control in Crawl Spaces in Louisiana- Improving the Durability of Wood-Frame Foundations for the Gulf Region



Homes with raised floors in New Orleans, Louisiana.

In flood-prone areas, elevating the floor system of a building above the anticipated flood level can significantly limit the extent of property damage associated with flooding. In hot and humid climates, such as the Gulf Coast region, homes have long been constructed with raised floors on crawl space foundations. Recent changes to building energy codes require floors to be insulated. The majority of residential buildings in the Gulf Region are now air-conditioned. The combination of floor insulation and air-conditioning, however, may put floor systems at risk for summertime moisture accumulation and related problems such as mold growth, decay, corrosion, and expansion/contraction damage. In response to a research gap and regional need, researchers from the Forest Products Laboratory, in cooperation with Louisiana State University Agricultural Center, monitored moisture and temperature levels in a dozen homes in New Orleans and Baton Rouge, Louisiana. This research confirmed several trends that were expected, relating to the effects of summer air-conditioning temperatures and impermeable interior floor finishes. It was found that foil-faced rigid foam board and closed-cell sprayed polyurethane foam insulation performed well, keeping subfloors from accumulating moisture. This work provides a research basis for builders, contractors, homeowners, architects, and building officials to make informed decisions. *Forest Products Lab (FPL), Madison, WI*

High Performance Nano-Cellulose Composites- Transparent Composites for Defense Applications



TEM micrograph of electrospun polymethyl methacrylate fibers containing 17 weight percent cellulose nano-crystals.

Cellulose nano-crystals (CNC) and cellulose nano-fibrils (CNF) provide strength properties equivalent to Kevlar and can be used in optically clear applications like composite windshields. The Forest Products Laboratory is supporting a project at the Army Research Laboratory in Aberdeen, MD, to produce and evaluate primarily clear composites as reinforced glass. The Forest Products Laboratory (FPL) has been working for three years on producing cellulose nanocrystals and the strongest and optically clearest versions of cellulose nano-fibrils. In 2009, FPL was approached by the Army Research Laboratory to help with a project producing optically clear composites. Because of the needs for larger amounts of materials, FPL began a scale-up project to produce both CNC and CNF at kilogram scales. FS Research provided additional funds for the pilot equipment needed to increase the process scale to about 20 kg. The Army Research Laboratory has been blending CNC and CNF in various resins, focusing on polymethyl methacrylate (PMMA) as the initial base resin because it provides optically clear panels and films and can be solvent cast. They have succeeded in incorporating CNC in electro-spun PMMA nano-fibers at 40 weight percent CNC. The electro-spinning process aligns the CNC in the fiber and maintains the dispersion. This enables researchers to laminate sheets with extra PMMA, producing composite sheets. Final sheets contained 1 weight percent CNC and maintained optical clarity. *Forest Products Lab (FPL), Madison, WI*

i-Tree- Tools for Assessing and Managing Community Forests



i-Tree is a state-of-the-art, peer-reviewed software suite from the USDA Forest Service that provides urban forestry analysis and benefits assessment tools. The i-Tree Tools help communities of all sizes to strengthen their urban forest management and advocacy efforts by quantifying the structure of community trees and the environmental services that trees provide. Since its release in 2006, more than 8,200 copies of i-Tree have been downloaded across the world. Program distribution is increasing globally at a rate of about 25% every year. In 2011 the number of countries using i-Tree reached 102 when the free software was downloaded in Hungary. Version 5.0 of i-Tree is scheduled for release in spring 2012. All programs are available freely at www.itreetools.org. *National program administered by Washington Office staffs, Washington, D.C.*

Million Trees LA

In Los Angeles, the current urban forest covers 21% and consists of about 11 million trees. Using research and models developed at Pacific Southwest Research Station, a team of scientists estimated the value, over a 35-year period, from one million trees in Los Angeles as \$1.3 to \$2.0 billion. Average



annual benefits were \$49 to \$60 per planted tree. For example, by storing carbon as biomass, one million new trees will reduce carbon dioxide in the air by about one million tons. This reduction is equivalent to removing 7,000 cars from streets and highways each year. “Million Trees LA” has planted over 300,000 trees to date, and PSW’s tree canopy cover maps have helped the program target trees for residential neighborhoods and commercial areas with the least tree canopy cover. This and other PSW research quantifying the benefits and value of California’s urban forests was instrumental in the development and approval of Proposition 84. This bond measure is providing \$90 million for urban forestry and urban greening projects in California. *Pacific Southwest Research Station, Vallejo, CA*

Black Ash Trees and the Emerald Ash Borer



Black ash has great cultural and economic importance in the Northeastern and Midwestern United States, especially for Native Americans. Widespread destruction and removal of black ash following the discovery of an emerald ash borer (EAB) infestation site is a painful prospect for tribes and basket-makers. Historically, black ash has sometimes been submerged for later use in basketmaking. In a recently completed study, a Forest Service entomologist working with a Forest Service geographer demonstrated that sinking black ash logs in running water for two to three months in the spring kills emerald

ash borer larvae and preserves the wood qualities necessary for basketmaking. The scientists worked with a family of basketmakers from the Gun Lake Tribe throughout the research. *Eastern Region Research Station, Milwaukee, WI*

Agroforestry



In alley cropping, an agricultural crop is grown simultaneously with a long-term tree crop to provide annual income while the tree crop matures. Fine hardwoods, like walnut, oak, ash, and pecan, are favored species in alley cropping systems and can potentially provide high-value lumber or veneer logs. Nut crops can be another intermediate product.

The USDA National Agroforestry Center, jointly sponsored by the Forest Service and the Natural Resources Conservation Service, works with partners to develop and deliver the science, tools, and training that help landowners and natural resource managers care for their land and maximize their profits. Agroforestry practices include riparian forest buffers along waterways; alley cropping which integrates crops, such as grains or vegetables, in alley ways with high-value trees and shrubs; forest farming where non-timber forest products such as food, herbals, botanicals, and decorative products are grown under the protection of a managed forest canopy; and field, farmstead, and livestock windbreaks.

To raise awareness and promote the science, practice, and benefits from agroforestry, USDA Deputy Secretary Kathleen Merrigan unveiled the *USDA Agroforestry Strategic Framework* on June 6, 2011, during the 12th North American Agroforestry Conference, in Athens, Ga. The framework lays the roadmap to influence the long-term health and sustainability of all lands for future generations. *National program administered by Washington Office staffs, Washington, D.C.*

Science Education Journals



The Natural Inquirer is a science education journal for middle school science students and educators, with articles adapted from published Forest Service research papers. In FY 2011, Forest Service R&D—in cooperation with the Conservation Education Staff, the Cradle of Forestry In America Interpretive Association, and other partners—published thousands of copies of the *Natural Inquirer* Climate Change edition and the Wildland Fire (second) edition. In partnership with the Pacific Northwest Research Station, the *Investigator*, an upper-elementary science journal, was published. This journal highlighted climate change research from the Pacific Northwest station. Forest Service R&D distributed 77,081 copies of the Natural Inquirer to students and teachers

nationwide and worldwide and an additional 10,714 copies of *Investigators*. The first World's Forest edition, published in partnership with the United Nations Food and Agriculture Organization, was translated into six languages, including Arabic, Chinese, French, Spanish, Russian, and Mongolian. *National publications administered by Washington Office Science Quality Services staff, Washington, D.C.*

eResearch Program



The eResearch program is a collection of initiatives designed to improve management, productivity and information sharing in the Forest Service's research community. Major components include the Research Information Tracking System (RITS), Data Storage and Archiving, and Treesearch. The eResearch program made substantial improvements to R&D's information infrastructure in FY2011. The Research Information Tracking System (RITS) expanded its user base from hundreds to

thousands as it began managing information about the research expertise and interests of its employees. This improved information management was demonstrated through collaborations with fellow research agencies in USDA to create the first federal implementation of VIVO, an open source web technology for enabling the discovery of researchers across institutions (<http://vivo.usda.gov>). RITS also began field testing new capabilities to track information on individual research studies. Forest Service R&D made the *Research Data Archive* (<http://www.fs.usda.gov/rds/archive>) available on the Internet and added an additional 50 research data sets in FY 2011. To improve long-term management of research data collected on Experimental Forests & Ranges (EFRs), the archive provided metadata training for scientists and EFR data managers. The archive also entered into an agreement to provide a number of services to the *Joint Fire Science Program* (<http://www.firescience.gov>) including training webinars for JFSP grant applicants; reviewing data management plans for grant proposals; providing metadata catalog services for all JFSP research projects; and serving as the recommended data repository for JFSP research projects. *National programs administered by Washington Office Science Quality Services staff, Washington, D.C.*

DOWNSTREAM OUTCOMES FROM 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 has consulted with ARS on strategies to seek partnerships between the federal government and industry to mature and commercialize Reclamation's three advanced water treatment technologies. Through Reclamation's relationship with ARS, Reclamation was able to enlist the support of TechComm to assist in seeking commercial partners for three advanced water treatment technologies. TechComm is a public-private partnership focused on the development and commercialization of emerging technologies to solve pressing national needs, create innovative products, create jobs, and stimulate economic growth. TechComm represents a coalition of government agencies and their federal labs including ARS and Department of Defense, as well as industry, academic, corporate, and venture capital affiliates.

Through the facilitation of TechComm, Reclamation has entered into a material transfer agreement with an industry partner to evaluate performance of the Chlorine Resistant Membrane and to determine possible interest for further collaboration. ARS helped Reclamation strategize and draft this material transfer agreement. TechComm has also been assisting Reclamation to seek commercial partners for two other water treatment technologies including New Generation Cellulose Acetate Reverse Osmosis Membrane and Forward Osmosis Water Purification. ARS also helped Reclamation draft another material transfer agreement with an industry partner to test and evaluate the cellulose acetate membrane formulations for commercial applications.

- **Chlorine Resistant Polyamide Osmosis Membranes.** Researchers from Reclamation, Separations Systems Technologies, and the University of Denver have collaboratively developed new group of chlorine resistant polymers (U.S. Patent No. 7,806,275 and U.S. Patent Application No. 12/861,233). A targeted use for these polymers is to create chlorine-resistant membranes for desalinating seawater or purifying other sources of impaired waters. This new membrane is designed to be chlorine resistant and can be made in existing manufacturing facilities without modification to existing equipment. The membrane is designed to be a drop in replacement for existing membranes. The potential benefits of the new membrane include the following:
 - Decrease chemical handling and use during water treatment
 - Simplify water treatment processes
 - Reduce membrane biofouling and extend membrane life
 - Decrease treatment plant operation and capital costs

Several of the new polyamide membrane prototypes tested indicated superior degree of chlorine

resistance and with transport properties equal to or better than traditional polyamide membranes. Because these prototypes demonstrated positive results, Reclamation has upscaled and manufactured the new membrane into 2.5" by 40" spiral wound reverse osmosis membrane elements and is currently going through long-term testing at Reclamation's Water Quality Improvement Center and Office of Naval Research Facility at Port Hueneme, California. Long-term, side-by-side tests are conducted on the new membrane and a commercially available reverse osmosis seawater polyamide membrane.

Ongoing research and development is being conducted on existing and other promising chlorine-resistant polyamide chemical formulations. Reclamation is seeking an industry partner(s) to participate in development and commercialization of this patented technology through cooperative research and/or license agreements.

Through the facilitation by TechComm, Reclamation has entered into a Material Transfer Agreement with an industry partner to evaluate performance of the membrane and to determine possible interest for further collaboration.

- **New Generation Cellulose Acetate Reverse Osmosis Membrane.** Researchers from Reclamation and Separations Systems Technologies had developed new cellulose acetate (CA) membranes (U.S. Patent Application No. 11/746,288) that can remove more salt at lower operating pressures than existing CA membranes. Relative to other types of reverse osmosis membranes, CA membranes are less expensive, have a longer life, require less cleaning, and are much more resistant to chlorine. However, due to impurities in the membrane that results from existing manufacturing processes, CA membranes do not remove as much salt and require higher pressure than other types of membranes. High operating pressures consume more energy and adequate salt removal can require additional treatment; both of which increase operating costs.

This new CA membrane incorporates a solvent processing step that is more effective at removing CA polymer impurities than previous methods. This new CA membrane technology performs better than existing cellulose acetate membranes by removing more salts at lower operating pressures. The membrane is designed to be a drop in replacement for existing membranes. It can be used in all membrane applications and industries including water and wastewater, food and beverage processing, pharmaceuticals and medical uses, and others.

Proof of concept tests were conducted on new CA prototypes at Separations Systems Technologies and test results showed lower salt passage and increased productivity. Because these prototypes demonstrated positive results, Reclamation had a membrane manufacturer scale up CA polymer processing and rolled and casted 2.5 inch by 40 inch spiral wound membrane element for pilot testing. Reclamation also had the same manufacturer cast and roll commercial membranes using the same formulation and starting material except for the CA polymer. Pilot testing of the new membrane and commercial membrane was completed at Reclamation's Water Quality Improvement Center and the test results indicate that three times the amount of salt is rejected as compared to commercially available cellulose acetate membranes while maintaining equal water production.

Reclamation has entered into a Material Transfer Agreement with an industry partner to evaluate performance of the membrane and to determine possible interest for further collaboration. TechComm is currently assisting Reclamation to seek commercial partners to participate in

development and commercialization through cooperative research and/or license agreements.

- **Forward Osmosis Water Purification.** Forward osmosis employs a membrane similar to reverse osmosis, but relies on the natural force of osmosis to drive the separation process. The advantage of using forward osmosis compared to pressure-driven membrane processes like reverse osmosis is that it operates at low pressures so less energy is used. In the forward osmosis process, if two solutions are placed on either side of a semi-permeable membrane, water will move toward the side with the higher concentration of solutes. For example, if a highly concentrated solution of water and fertilizer (the “driving solution”) is placed on one side of the semi-permeable membrane and a volume of seawater (the “feed water”) is placed the other, the natural force of osmosis would pull pure water of the seawater and through the membrane, resulting in a larger volume of water and fertilizer. In forward osmosis, selecting the proper driving solution determines the end use of the forward osmosis product, and the salinity of the feed water determines its maximum dilution. Researchers from Reclamation and Separations Systems Technologies had developed a driving solution and a new forward osmosis process (U.S. Patent Application No. 11/865,897) that removes and recycles the driving solute to produce drinkable water. They have also developed cellulose ester hollow-fiber forward osmosis membranes that are thin, strong, and offer more desalting surface area per unit volume as compared to flat sheets. Future development plans consist of pilot testing and maturing the forward process and driving solution as well as hollow-fiber membranes. TechComm is currently assisting Reclamation to seek commercial partners to participate in development and commercialization of through cooperative research and/or license agreements.

SAMPLING OF ARS FIELD DAY EVENTS



California:

Crop Diseases, Pests and Genetics Research Unit

- Hosted Almond Stakeholder Meeting at the San Joaquin Valley Ag Sciences Center, Parlier, CA. Presented research progress on genetic improvement of almond to 23 stakeholders (12/1/2010).
- Hosted Stone Fruit Stakeholder Meeting at the San Joaquin Valley Ag Sciences Center, Parlier, CA. Presented research progress on genetic improvement of stone fruits to 14 stakeholders (5/25/2011).
- Hosted Table and Raisin Grape Selection Evaluations. Current selections of the Unit's raisin and table grape breeding project were presented to stakeholders for comments (10/20/2010, 11/17/2010, 12/2/2010, 8/23/2011, and 9/30/2011).

Commodity Protection and Quality Research Unit

- Hosted at the San Joaquin Valley Ag Sciences Center, Parlier, CA., individuals selected for the Almond Board of California Leadership Program for a "job shadowing" field day (9/21/2011).
- Hosted the area wide NOW (Navel Orangeworm) project Stakeholder Meeting. The audience included university researchers, extension agents, insecticide company representatives, professional crop advisers, Area Office and National Program Staff (9/28/2011).
- Hosted the area wide NOW (Navel Orangeworm) project technology transfer meeting at the International Agri-Center, Inc., Tulare, CA. Attendees included university researchers, extension agents, insecticide company representatives, professional crop advisers, and growers (4/5/2011).

Water Management

- Hosted Pomegranate Project Field Day. Provided research progress on the pomegranate fertilization project to invited donors of equipment and the representatives of the funding agencies (10/29/2010).

National Arid Land Plant Genetic Resource Unit

- Hosted a booth at the World Ag Expo, Tulare, CA., The World Ag Expo is the largest annual agriculture exposition of innovative agriculture methods, crops and equipment and is attended by people in agribusiness and the general public (2/8-10/2011).
- Hosted a booth at the Fresno Farm and Nutrition Day, Fresno, CA, for students and the general public (3/18/2011).
- Hosted a booth at the Fresno Water-Wise Plant Exchange, Fresno, CA, for home gardeners and the general public (5/7/2011).

Western Integrated Cropping Systems Research Unit

- Hosted the annual Cotton Research Field Day at the Shafter Cotton Research Station, Shafter, CA. The field day was attended by approximately 40 California cotton growers, professional crop advisers, and industry representatives (9/13/2011).

Colorado:

Central Great Plains Research Station

- Hosted a field day on the Remediation of Eroded Soils, Akron, CO. The field day was attended by farmers, ranchers, Natural Resources Conservation Service, Agribusiness and extension (6/15/2011).

Water Management Research Unit

- Celebrated 100 year anniversary. Over 85 people attended the celebration (9/29-10/2011).

Florida:

Insect Behavior and Biocontrol Research Unit

- Co-host with Florida A&M University the 11th Annual Grape Harvest Festival at the Florida A&M Center for Viticulture and Small Fruits Research. Over 2000 people attended the Festival and participated in tours of ARS and University laboratories and research plots (8/27/2011).

Insect Behavior and Biocontrol Research Unit

- Convened the Unit's Liaison Committee. The committee membership reflected many facets of the Florida agriculture and conservation community, such as specialty vegetables, citrus, and organic growers, industry representatives and those interested in invasive plants and animals (8/31/2011).

U.S. Horticultural Research Laboratory

- Hosted various events: Industry Liaison Meeting (10/8/2010 and 5/13/2011), Florida Nursery Growers Landscape Association (11/30/2010 and 8/9/2011), Indian River Citrus League (12/10/2010), St. Lucie County Coalition Meeting (1/27/2011), Florida Nursery Growers Landscape Association (2/17/2011), Sustainable Biodiesel Industry Workshop (3/16/2011), Open House (4/1/2011), Indian River Citrus League (4/7/2012), St. Lucie County Chamber of Commerce (4/14/2011), Class on Economic Development (4/14/2011), Treasure Coast Economic Research & Development Association (4/14/2011), booth at Extreme Energy Event

(5/14/2011), Citrus Research Development Foundation (5/24/2011), Indian River Citrus League (6/7/2011), Tour for Citrus Growers (6/27/2011).

Subtropical Horticulture Research Station

- Partnered with Future Scientists Project, Texas A&M University and the USDA/Hispanic Serving Institutions National Program (HSINP) to reach out to communities and schools (Grades K-12) with hands-on, inquiry-based activities that link them with USDA/ARS scientists, laboratory sites and current agricultural science research.
- Hosted the Station's liaison group, Friends of Chapman Field, annual business meeting. The meeting included scientific progress reports from all research scientists. Immediately following this meeting, the location welcomed the public from the Miami-Dade surrounding area to its annual Community Day/Open House. preferences, and plants for sale by local garden clubs. There were over 600 attendees to this event (6/4/2011).
- Participated in the Summer Fruit Fest presented by Miami-Dade Department of Recreation and Parks, Fruit and Spice Park in Homestead, Florida. The festival was attended by over 2,500 area residents (6/11-12/2011).

Georgia:

Cotton Technology Transfer Coordinator

- Chaired the Cotton Ginning Technical Conference at the Beltwide Cotton Conference Atlanta. University and ARS researchers and gin equipment manufactures provided technical presentations (1/6-7/2011).

National Peanut Research Laboratory

- Co- hosted with the Albany State University's Flint River Water Planning and Policy Center, Albany, GA, a tour of the Multi-crop Irrigation Research Farm to discuss feasibility, installation, and management of drip and sprinkler irrigation in peanut, corn, and cotton production. Approximately 45-50 farmers attended the tour (9/15/2011).
- Hosted the Mississippi Peanut Producers Association, The American Peanut Council's Food Writers Tour, and the American Peanut Shellers Association Operations Research Committee for tours related to production management, aflatoxin research, biotechnology and molecular biology, peanut grading and quality determination, storage and handling, genetics, and biodiesel research (various dates).

Hawaii:

Tropical Plant Genetic Resources and Disease Research Unit

- Hosted field days regarding functions and research of the USDA repository system: Hilo business groups (1/7/2011, 3/1/2011), college students (3/24/2011, 9/15/2011), teacher group (3/25/2011), individual business or scientists (2/7/2011; 3/30/2011; 9/20/2011; 4/1/2011, 4/6/2011 and 7/12/2011), senior group (5/19/2011), lecture meeting with tropical fruit growers (9/9/2011), third graders visited repository (9/13/2011), ASHS field tour of the repository after conference (9/29/2011), curators from 3 USDA germplasm sites tour repository (9/27/2011), and Korean scientists tour (9/28/2011), and Chinese scientists tour (9/29/2011).

Idaho:

Northwest Irrigation and Soils Research Laboratory

- Hosted tour to present storage research, Paul, ID. The purpose of the tour was to present research associated with storage and disease management in sugarbeet to growers, industry personnel, and scientists (2/3/2011).
- Presented research on sugarbeet disease control as part of the Amalgamated Sugar Company's Variety Trial tour held across southern Idaho. The purpose of the tour was to present nurseries and sugarbeet research to growers, industry personnel, and scientists (8/30/2011).

U.S. Sheep Experiment Station

- Hosted field tour of research activities (8/16/2011).

Small Grains and Potato Germplasm Research Unit

- Participated in the Twilight Tour at the University of Idaho Research and Extension Center. Presented poster displays on research and tours of the ARS facility. Target audience was the general public (7/21/2011).
- Hosted a Barley Field Day to barley growers (7/12/2011).
- Hosted Western Wheat Workers visit for presentations, field and lab tours (6/29/2011).

Northwest Watershed Research Center/ Reynold's Creek Experimental Watershed

- Participated in a teacher's outreach program at the called "Into the Watershed." Eight Idaho high school teachers spent three days learning about the ARS Ecologically Based Invasive Plant Management (EBIPM) Program and the Watershed Hydrology (5/5-7/2011).
- Participated in a Sagebrush Steppe Treatment Evaluation Project (SageSTEP) tour. Over 30 Land Managers participated in the tour (5/18/2011).
- Participated in the Reynold's Creek Experimental Watershed landowner meeting (6/16/2011).
- Hosted a tour on juniper research and effects of fire for the Director of Social Science at the University of Idaho, graduate students and faculty (8/11/12/2011).
- Presented training and information at the Ecologically-Based Invasive Plant Management (EBIPM) Field School for land and resource managers, Park Valley, UT. The Field School presented one of five demonstration areas of the Area-wide Project, ongoing field work and research focused on establishing a weed prevention area, characterizing historical ecology, reducing cheatgrass and other invasive species and re-establishing a native plant community through implementation of EBIPM. (9/15-17/2011).

Indiana:

Crop Protection and Pest Control Research Unit

- Hosted an information/education booth as part of its outreach activities at the Purdue Spring Fest, West Lafayette, IN. Approximately 40,000 people attended the event (4/15/2011).

Iowa:

Crop Insects and Crop Genetics Research Unit

- Co-hosted with Cornell University, New Mexico State University, Practical Farmers of Iowa, Michael Fields Agriculture Institute, and Montgomery field day on “Strengthening Public Corn Breeding to Ensure Organic Farmers Have Access to Elite Cultivars.” Sixty-two researchers, seed company representatives, and producers attended (9/13/2011).

Kansas:

Center for Grain and Animal Health Research

- Co-hosted with Kansas State University the Wheat Field Day at the KSU North Agronomy Farm, Manhattan, KS. Approximately 120 people attended the field day (5/31/2011).

Louisiana:

Honey Bee Breeding, Genetics, & Physiology Laboratory

- Hosted the 14th annual Field Day. Three sessions were held: 1) Beekeeping for Beginners, 2) Queen-rearing Workshop, and 3) Interactive Demonstrations. Approximately 240 beekeepers attended the event (10/23/2011).

Sugarcane Research Unit

- Co-hosted with Louisiana State University the Sugarcane Field Day at the Ardoyne Research Farm, Houma, LA,. There were 72 participants including growers, millers, and university extension and research personnel (6/3/2011).
- Hosted the Louisiana State University Cooperative Extension Service Winter Meeting. County Agents used the information presented to develop spring grower meeting topics for their respective parishes (1/19/2011).

Maryland:

Beltsville Area

- Presented research outcomes at Regional Rural Forums throughout the State to address farmers’ needs: Eastern Shore forum focused on “green” poultry production and improved land usage (12/2/2010); Southern forum focused on alternative crops and land management (1/27/2011); and Northeastern Forum focused on energy crops and cattle / dairy production (4/26/2011).
- Hosted laboratory / field tour of research programs on farming systems, food safety, composting, remote sensing and strawberry breeding for extension agents and economic development personnel (8/23/2011).
- Hosted USDA Secretary’s Retreat Research Tour. Attended by about 50 people (6/10/2011).

Sustainable Perennial Crops Laboratory

- Held two field day events (10/4/2010 and 6/10/2011).

- Participated in USDA Science Week exhibit at Whitten Building in Washington DC.

U.S. National Arboretum

- Hosted a booth and research display at Mid-Atlantic Nursery Trade Show in Baltimore, MD. Attended by for 15,000 growers (1/5-7/2011).

Sustainable Agricultural Systems Laboratory

- Hosted field day to highlight on-farm research at Eden, MD. Attended by for 65 people (8/1/2011).
- Co-organized 7th Annual Organic Grains, Forages and Vegetables Workshop in Queen Anne's County. Attended by about 100 people from Maryland, New Jersey, Delaware, Pennsylvania, and Virginia (3/6/2011).

Bee Laboratory

- Held field day. Attended by 200 beekeepers, general public and policy makers (6/2001).

Michigan:

Sugar Beet and Bean Research Unit

- Participated in the Sugar Beet Diagnostic Day at Michigan State University's Saginaw Valley Research and Education Center. Presented research results and practical techniques. Over 100 local growers, field consultants, and private industry participants attended the event.
- Participated in the annual research reporting session for the Michigan Research and Education Advisory Council (REACH). This presented an opportunity to present sugar beet research results. Over 60 sugar beet industry representatives attended the event.

Minnesota:

North Central Soil Conservation Research Lab

- Hosted Field Day on "Sustainable Landscapes: Food, Feed, Fuel, and Future" (8/18/2011).
- Participated in the Stevens County Fair/Stevens County Agricultural Society and presented several seminars throughout the year as a part of its strategy to inform and educate the local community about our mission and research program (8/10-14/2011).
- Participated in other activities used to promote the lab and to highlight the impact of our research program at the local and national levels include: participating as speakers at field days of cooperators and Research and Outreach Centers, having booths at community events such as Horticulture night and the Community Connections Expo, writing articles for the local newspaper and doing radio spots on the local radio station, and giving tours of the lab to students, local and international groups.

Plant Science Research Unit

- Co-organized with University of Minnesota Extension three summer field day training sessions on "Nutrient Management for Alfalfa-Corn Rotations." The field days were developed as a

means to transfer technology learned in cooperative, on-farm field research to farmers, their advisors, and agency personnel.

Mississippi:

Cotton Technology Transfer Coordinator

- Organized with the National Cotton Ginners Association three annual Cotton Ginning School, Stoneville, MS, Lubbock, TX, and Mesilla Park, NM. Approximately 250 participated in the events, along with 24 instructors from ARS, universities, and industry (4/2011, 5/2011, 6/2011).

Catfish Genetics Research Unit

- Co-organized with the Mississippi State University National Warmwater Aquaculture Center a workshop on the production of channel x blue hybrid catfish fry at the Capps Center, Delta Regional and Extension Center, Stoneville, MS (4/6-7/2011).

Thad Cochran Southern Horticultural Laboratory

- Participated in the Mississippi State University Ornamental Horticulture Field Day at the Coastal Research and Extension Center, South Mississippi Branch Experiment Station, Poplarville, Mississippi. The field day was attended by over 100 representatives of the ornamental industry (10/6/2011).

Montana:

Fort Keogh Livestock and Range Research Laboratory

- Hosted the Western Section of the American Society of Animal Science Beef Symposium. The Symposium had over 100 participants (6/21/2011).

Nevada:

Great Basin Rangelands Research Unit

- Participated in the University of Nevada's Biotechnology and Natural Resources Field Day, Reno, NV (9/30/2011).

New Mexico:

Range Management Research

- Co-conducted with the Asombro Institute (non-profit science education program) 21 field trips to the Jornada Experimental Range for K-12 students. These field trip programs involved a total of 1555 K-12 students, 93 teachers, and 74 parents.

New Orleans:

Cotton Technology Transfer Coordinator

- Organized the Technical Committee on Cotton Quality meeting, New Orleans, LA. Meeting was attended by 32 ARS researchers, cotton and textile equipment manufacturers, cotton merchants, and industry representatives from the Cotton Board, LA Cotton Producer Association, Cotton Incorporated, and Agriculture Marketing Service (9/7-8/2011).

New York:

Plant Genetic Resources Unit

- Participated with Oregon State University through the Northern Organic Vegetable Improvement Collaborative (NOVIC) in three events centering on organic farming stakeholders.
- Participated in the Common Ground Country Fair, Unity, ME and the Mother Earth News Fair in Seven Springs, PA. These two events gave staff the opportunity to interact with the organic farming community. Over 59,000 and 30,000 people respectively attended these events (9/2011).

North Dakota:

Northern Great Plains Research Laboratory

- Awarded the 2011 Merit Award by the International Soil and Water Conservation Society for excellence in technical transfer of USDA-ARS research and development of the successful annual "USDA Friends & Neighbors Day." The FY2011 event was attended by more than 900 (7/21/2011).

Ohio:

Soft Wheat Quality Laboratory

- Hosted the 58th Annual Research Review, Wooster, OH, which discussed new wheat germplasm, molecular marker selection, recent developments in the definition and methodology of dietary fiber, and whole grain near infra-red calibration. Over 100 people attended this review (3/2011).
- Hosted two field days at the North Appalachian Experimental Watershed (NAEW) near Coshocton, Ohio.
- Hosted a NRCS Student Orientation Workshop for trainees from work locations throughout Ohio (7/13/2011).
- Co-conducted with soil scientists from the Association of Ohio Pedologists training for approximately 50 Certified Crop Advisors and others (8/18/2011).

Oklahoma:

Grazing Lands Research Laboratory

- Hosted the 2011 National Cavalry Competition, El Reno, OK.

Southern Plains Range Research Station

- Hosted “Old World Bluestem Management on the Southern Plains” symposium, Woodward, OK on establishment to grazing management. It also introduced bluestem use as a biomass for ethanol production and how established stands may be integrated into wildlife management programs. Approximately 90 people attended the event.

Oregon:

Horticultural Crops Research Laboratory

- Hosted field day and tour of Blueberry Breeding Program to the general public, small fruit growers, and processors (8/25/2011).
- Participated with *Oregon State University* on a Spotted-wing *Drosophila* Workshop to educate growers and the public on the biology and management of the insect (4/21/2011).
- Participated in workshop with Olsen Family Vineyards, Monmouth, OR. Provided information on the soil, root and vine interface in the vineyard. Participants included farmers, graduate students, and extension faculty (7/28/2011).
- Participated in Field Days with Del Rio Vineyards, Gold Hill, OR. Provided information on grapevine nutritional monitoring programs for vineyards to growers using an interactive approach including games, photographs, and written materials (5/17/2011).
- Hosted a workshop on scouting grapes for powdery mildew. Approximately 75 growers attended the event. (5/17/2011).

National Clonal Germplasm Repository

- Hosted laboratory tours and peony field tours in conjunction with the American Peony Society during their national annual meeting in Wilsonville, OR (5/27-29/2011).

Range and Meadow Forage Management Research

- Hosted the Jordan Valley Annual Grass Management Field Day. Provided presentations, activities and plot tours of area-wide research project on annual grasses. Approximately 25 attended the event (6/6/2011).
- Hosted the Circle Bar Ranch Ecologically-based Plant Management (EBIPM) model workshop. Provided a program on managing invasive species using a cooperator’s ranch. The event was attended by 28 college students and 15 land managers (4/16/2011).
- Coordinating with other ARS scientists in Boise, ID and Logan, UT an EBIPM workshop on managing invasive annual plants, Park Valley, UT. Approximately 50 land managers and producers attended the event (9/13-15/2011).
- Hosted a booth at the Harney County Fair, Burns, OR. Displayed products developed from research conducted at the station. There were over 1000 fair attendees. (9/7-11/2011).

Panama:

Screwworm Research Unit

- Participated in an open house, along with all other Departments located at the Sterile Screwworm Production Facility. The open house was attended by representatives of the American Embassy in Panama, the Panamanian Government, other Panamanian groups (such as Cattlemen's Association) and local citizens (3/15/2011).

Pennsylvania:

Molecular Characterization of Foodborne Pathogens

- Participated in Rodale Institute Field Day. Provided a general introduction to mycorrhizal fungi, and demonstrated ARS research system for the on-farm production of inoculum of arbuscular mycorrhizal [AM] fungi (7/22/2011).

Pasture Systems and Watershed Management Research Laboratory

- Participated in multiple field days across the North Atlantic Region. Presented research results on improved management of pasture resources for northeastern livestock farms and nutrient management practices to protect air and water resources. Reached an estimated audience of 600.
- Participated in a field day on Sustainable Cropping Systems in Rock Springs, PA. Provided an overview of agronomic, air and water quality trade-offs in using alternative manure application technologies. Approximately 75 farmers, action agency representatives and members of the general public attended.(6/22/2011).

Puerto Rico:

Tropical Agriculture Research Station

- Co-hosted with the Cortés Chocolate Company and the University of Puerto Rico Extension Service the 2011 Cacao Workshop. Presented research finding on all aspects of cacao production included a hands-on learning field day. The workshop audience, of about 50 individuals, consisted of current farmers and potentially new farmers interested in this crop as well as personnel from state and local governmental agencies.

South Carolina:

Coastal Plains Soil, Water, and Plant Research Center

- Hosted the 12th Annual Customer/Partner Workshop, Florence, SC. The goal was to foster cooperation and collaboration in agricultural research, especially in the southeastern United States. The workshop was attended by 62 people representing farmers, district commissioners, extension workers, university researchers, and other federal agencies (11/16/2010).

South Dakota:

North Central Agricultural Research Laboratory

- Celebrated its 50th anniversary with their annual Field Day, Brookings, SD. Presented research results, exemplifying management options to decrease the application of agricultural chemicals while maintaining crop yield and quality. There were over 50 attendees (6/21/2011).

Texas:

Knipling-Bushland U.S. Livestock Insects Research Laboratory

- Hosted the APHIS-ARS Screwworm Research Quarterly Meeting, Kerrville, TX (11/2010).
- Participated in the 2011 Annual South Texas Beef Cattle Short Course, San Antonio, TX, hosted by Texas AgriLife Extension Service. The event was attended by 146 (1/2011).

Grassland Soil and Water Research Laboratory

- Co-hosted with Texas AgriLife Extension and Research the Bell County Blackland Field Day. Approximately 50 local producers attended the event.

Cropping Systems Research Laboratory

- Hosted a cotton field tour for the Cotton Incorporated Board Members. Approximately 20 producers attended (8/23/2011).

Washington:

Root Disease and Biocontrol Research Unit

- Participated in the Cook Agronomy Farm Field Day, Pullman, WA. Presented information on acid soils and aluminum toxicity. Approximately 150 farmers attended (6/23/2011).
- Participated in Crop Disease Clinic, Spillman Farm, Pullman, WA. Presented material on root diseases, diagnosis and management. Approximately 75 farmers attended (7/6/2011).
- Hosted field days at Fairfield and Rockford, WA. Presented information on acid soils and aluminum toxicity and demonstrated field plots testing liming and variety response to acid soils. Approximately 50 farmers attended (6/21/2011).

Grain Legume Genetics Research Unit

- Hosted 4 field tours at Spillman Farm, Pullman, WA (Brocke and Sons, ProGene, Pacific Northwest Coop, "Spillman Field Day"). Target audiences for tours were growers (farmers) and seed companies.
- Participated in 3 field days with WSU Variety Testing, Walla Walla, WA, LaCrosse WA and Farmington WA. Target audiences for tours were growers (farmers) and seed companies.
- Participated in University of Idaho's field tour, Fairfield WA. Target audiences for tours were growers (farmers) and seed companies.
- Participated in Montana State University's field tour, Moccasin, MT. Target audiences for tours were growers (farmers) and seed companies.

Wheat Genetics Lab

- Participated in Washington State University's Field Days at locations throughout Washington State.
- Hosted approximately 20 such tours for trade groups, college classes, and others.

Land Management Water Conservation Research Unit

- Participated in Washington State University Cook Farm's Field Day.
- Conducted a drill demonstration in St. John, WA.

West Virginia:

Appalachian Farming Systems Research Center

- Hosted the West Virginia Forage and Grassland Council for a research overview and tour of the facilities (5/26/2011).

Wisconsin:

Cereal Disease Lab

- Hosted the Wheat Stem Rust Surveillance Workshop, St. Paul, MN (10/14-15/2011).
- Hosted the North American Rust Workers Workshop, St. Paul, MN. Rust researchers from 15 countries attended. Over 300 people from around the world participated in the event in St. Paul (6/13-16/2011).

U.S. Dairy Forage Research Center

- Conducted two starch method training sessions, Madison, WI. Attendees included analysts from seven (7) commercial feed analysis laboratories, graduate students, as well as university faculty, some of whom participated in the seminars only.

Wyoming:

Rangeland Resources Research Unit

- Hosted the first regional Ecological Site Applications workshop was held at the Shortgrass Steppe Research and Interpretation Center near Nunn, Colorado, and Cheyenne, Wyoming. The workshop focused on how to use and interpret Ecological Site Descriptions (ESD) and also helped SRM and agency partners identify methods to successfully implement future ESD workshops and training. The workshop hosted 40 registrants from a variety of organizations and a wide range of skills and experience with ESDs (8/23-25/2011).

ARS GERMLASM DISTRIBUTION

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. This table lists the number of distributions from each NGRP repository to different organizational categories. *These repositories did not distinguish the distribution category.

<i>Repository</i>	<i>Organizational Category</i>												
	UARS	UFED	STA	UCOM	UPRU	UIND	UAI D	INT	FGEN	FCOM	FPRU	FIN D	Total
BRW	-	-	-	-	-	-	-	-	-	-	-	-	141*
COR	678	0	817	599	234	2311	0	0	0	106	400	65	5210
COT	2396	0	558	186	1	59	0	0	1145	30	79	0	4454
DAV	11	0	238	1187	282	3058	0	0	19	0	378	120	5293
GEN	921	1	1923	635	248	2034	0	0	0	0	1246	24	7032
GSOR	1412	0	2954	3182	17	540	0	0	82	8	888	0	9083
GSPI	0	0	50	3	0	0	0	0	0	0	41	0	94
GSZE	-	-	-	-	-	-	-	-	-	-	-	-	8305*
HILO	89	6	55	46	1	23	0	0	9	14	13	0	256
MAY	43	31	92	69	33	228	0	0	0	0	0	0	496
MIA	207	4	59	63	45	16	0	0	0	10	49	0	453
NA	-	-	-	-	-	-	-	-	-	-	-	-	184*
NC7	2143	174	7284	8875	643	1862	0	0	5610	4890	7574	33	39088
NE9	41	4	568	721	100	1101	10	0	10	215	1048	20	3829
NR6	1045	0	1267	764	84	50	0	2	0	21	445	0	4178
NSGC	12410	0	21575	8049	108	1424	0	4326	573	1176	17544	163	67348
NSSL	547	0	34	29	7	36	0	0	0	13	37	9	712
NTSL	1015	0	0	0	0	0	0	0	0	0	0	0	1015
OPGC	14	0	154	344	10	112	0	0	0	2	139	12	787
PALM	113	0	180	101	24	255	0	0	0	0	17	14	704
PARL	210	11	41	1	5	92	0	0	0	20	88	0	468
RIV	245	0	172	32	3	60	0	0	0	4	641	163	1320
S9	9513	19	8007	4853	274	1469	0	17	211	6377	1645	127	32512
SOY	13802	0	7258	3800	6	522	0	0	827	64	379	296	26954
TGRC	-	-	-	-	-	-	-	-	-	-	-	-	6204*
W6	1878	25	5855	1070	966	1714	0	86	4458	1711	12148	35	29946
Total	48733	275	59141	34609	3091	17466	10	4431	12935	14661	44799	1081	256068

ARS GERMPLASM DISTRIBUTION KEY

ORGANIZATIONAL 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, and **UPRU**=U.S. non-profit organization.

REPOSITORIES:

BRW Natl. Germplasm Repository - Brownwood
COR Natl. Germplasm Repository - Corvallis
COT Cotton Collection
DAV Natl. Germplasm Repository - Davis
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
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
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

GERMPLASM DISTRIBUTION MAP



Addendum 1

ARS TECHNOLOGY TRANSFER AWARD WINNERS

2011 ARS Technology Transfer Awards

Technology Transfer Category

Scientists: Dr. Ken Overturf et al., Small Grains and Potato Germplasm Research Unit, Hagerman, Idaho

Citation: For developing improved rainbow trout and plant-based trout feed for U.S. aquaculture

Award: ARS Superior Award

Scientists: Dr. Fred Shih et al., Food Processing and Sensory Quality Research Unit, New Orleans, Louisiana

Citation: For the enhanced utilization of rice based frying batters in commerce

Award: ARS Outstanding Award

Scientists: Dr. Gloria DeGrandi-Hoffman, Carl Hayden Bee Research Center, Tucson, Arizona

Citation: For developing a new product to safely and effectively control Varroa mites in honey bee colonies

Award: ARS Superior Award

Scientists: Dr. Gregory Holt, Cotton Production and Processing Research Unit, Lubbock, Texas

Citation: For development and transfer of technology to utilize cotton gin by-products for biodegradable packing and insulation board

Award: ARS Superior Award

Scientists: Dr. David Marshall et al., Plant Science Research Unit, Raleigh, North Carolina

Citation: For the development, release, and adoption of specialty wheat varieties for farmers, millers, and bakers, and for organic, local foods in North Carolina

Award: ARS Superior Award

Sustained Effort Category

Scientists: Dr. Jack Comstock et al., Sugarcane Production Research Unit, Canal Point, Florida

Citation: For the sustained transfer of high yielding CP sugarcane varieties to Florida and internationally and the transfer of variety selection procedures to Central America

Award: ARS Outstanding Award

Scientists: Dr. Benjamin Matthews et al., Foodborne Contaminants Research, WRRRC, Albany, California

Citation: For development of monoclonal antibody technology to detect the antibiotic Ceftiofur and its metabolites in milk

Award: ARS Superior Award

Scientists: Dr. Jack Staub et al., Forage and Range Research Laboratory, Logan, Utah

Citation: For development and transfer of improved plant materials for increased productivity, conservation, reclamation, renovation, and restoration of western U.S. semiarid rangeland and pastures

Award: ARS Superior Award

2011 Federal Laboratories Consortium (FLC) Awards

Scientist: Dr. Patrick Gatch Hunt, Coastal Plains Soil, Water, and Plant Research Center, Florence, South Carolina

Title: Director of the Year Award

Award: National Excellence in Technology Transfer

Scientists: Dr. Heping Zhu et al., Application Technology Research Unit, Wooster, Ohio

Title: Comprehensive Application Technology and Strategy to Reduce Pesticide Use

Award: National Excellence in Technology Transfer

Scientists: Dr. David Geveke et al., Food Safety and Intervention Technologies Research Unit, Wyndmoor, Pennsylvania

Title: Flash Pasteurization for Improving the Food Safety of Hot Dogs

Award: National Excellence in Technology Transfer

Scientists: Dr. Tom Pearson et al., Center for Grain and Animal Health Research, Manhattan, Kansas

Title: Instrument for Rapid Detection of Insect Infested Grain

Award: National Excellence in Technology Transfer

Scientists: Dr. David Suarez et al., Southeast Poultry Research Laboratory, Athens, Georgia

Title: Real-time RT-PCR for Pandemic H1N1 Influenza in Veterinary Specimens

Award: National Excellence in Technology Transfer

Scientist: Dr. Gloria DeGrandi-Hoffman, Carl Hayden Bee Research Center, Tucson, Arizona

Title: HOPGUARD

Award: Far West Region Award for Outstanding Commercialization Success

Scientists: Dr. Kenneth Overturf and Dr. Richard Barrows, Small Grains and Potato Germplasm Laboratory, Aberdeen, Idaho

Title: Plant-based Trout Diet

Award: Far West Region Award for Outstanding Commercialization Success

Lab: Agricultural Research Service, the Pennsylvania State University, Virginia Polytechnic Institute and State University, University of Maryland Eastern Shore, University of Maryland, Cornell University, and University of Delaware

Award: Mid-Atlantic Educational Institution and Federal Laboratory Partnership Award

Lab: Forage and Range Research Laboratory, Logan, Utah

Award: Mid-Continent Award for Outstanding Laboratory

Lab: Poisonous Plant Research Laboratory, Logan, Utah

Award: Mid-Continent Award for Outstanding Laboratory

Scientist: Dr. Gregory Holt, Cotton Production and Processing Research Unit, Lubbock, Texas

Title: Biodegradable Molded Packaging and Insulation Board Products from Cotton Gin Byproducts

Award: Mid-Continent Award for Excellence in Technology Transfer

Lab: Roman L. Hruska U.S. Meat Animal Research Center, Clay Center, Nebraska

Title: iPSNP Consortium Development of the Illumina PorcineSNP60 BeadChip™

Award: Mid-Continent Award for Excellence in Technology Transfer

Scientists: Dr. Terrance Booth, Samuel Cox, and Robert Berryman, High Plains Grasslands Research Center, Cheyenne, Wyoming

Title: Range Management Software System

Award: Mid-Continent Award for Notable Technology Development

Scientists: Dr. Steven Cermak and Dr. Terry Isbell, Bio-oils Research Unit, Peoria, Illinois

Title: Commercialization of Estolides as a Biobased Functional Fluid

Award: Midwest Award for Excellence in Technology Transfer

Scientists: Dr. Robert Danka and Dr. Jeffery Harris, Honey Bee Breeding, Genetics and Physiology Laboratory

Title: Honey Bees with Varroa Sensitive Hygiene

Award: Southeast Award for Project of the Year

Scientist: Dr. Agnes Rimando, Natural Products Utilization Research, Oxford, Mississippi

Title: Health Benefits of Pterostilbene

Award: Southeast Award for Excellence in Technology Transfer

Scientists: Dr. Frederick Shih et al., Food Quality and Sensory Quality Research Unit, New Orleans, Louisiana

Title: Low Oil Uptake Rice Flour Batters

Award: Southeast Honorable Mention Award for Excellence in Technology Transfer

Technologies Highlighted in the 2011 Issue of FLC Technology Today

Scientists: Dr. Steven Cermak and Dr. Terry Isbell, Bio-Oils Research Unit, Peoria, Illinois

Title: Plant-Based Motor Oils from ARS Bio-Oils Research Unit

Scientists: Dr. Larry Stanker, Foodborne Contaminants Research Unit, Albany, California

Title: Got Milk? ARS Develops Test to Keep It Safe

Scientists: Dr. Gloria DeGrandi-Hoffman, Carl Hayden Bee Research Center, Tucson, Arizona

Title: Hops Protect Honey Bees from the Scourge of Mites

Scientists: Dr. Gregory Holt, Cotton Production and Processing Research, Lubbock, Texas

Title: Packaging that Grows Solves the Problem of Cotton Gin Waste

Scientists: Dr. Ken Overturf and Dr. Rick Barrows, Small Grains and Potato Germplasm Research, Aberdeen, Idaho

Title: Fish Story has Happy Ending for American Aquaculture and Consumers

Scientists: Dr. Fred Shih and Ms. Kim Daigle, Food Processing and Sensory Quality Research, New Orleans, Louisiana

Title: ARS Rice Batter Recipe Provides Healthier Fried Food

Addendum 2

SELECTED METRIC CHARTS FOR ARS
(data extracted from Tables 1-7)

Figure 1. Number of CRADAs executed for FY2007-FY 2011.

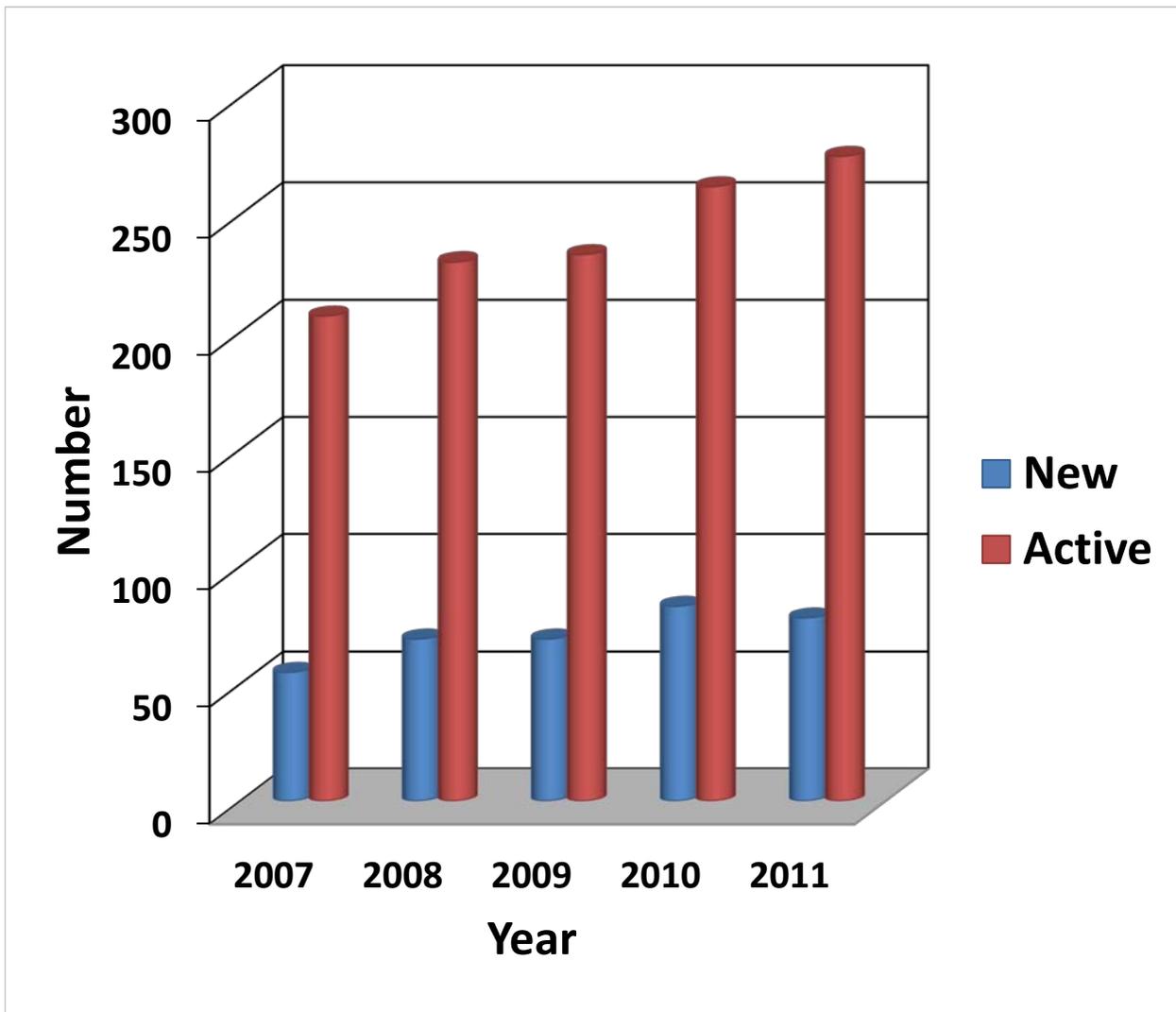


Figure 2. Percentage of active CRADAs in FY 2011 by type.

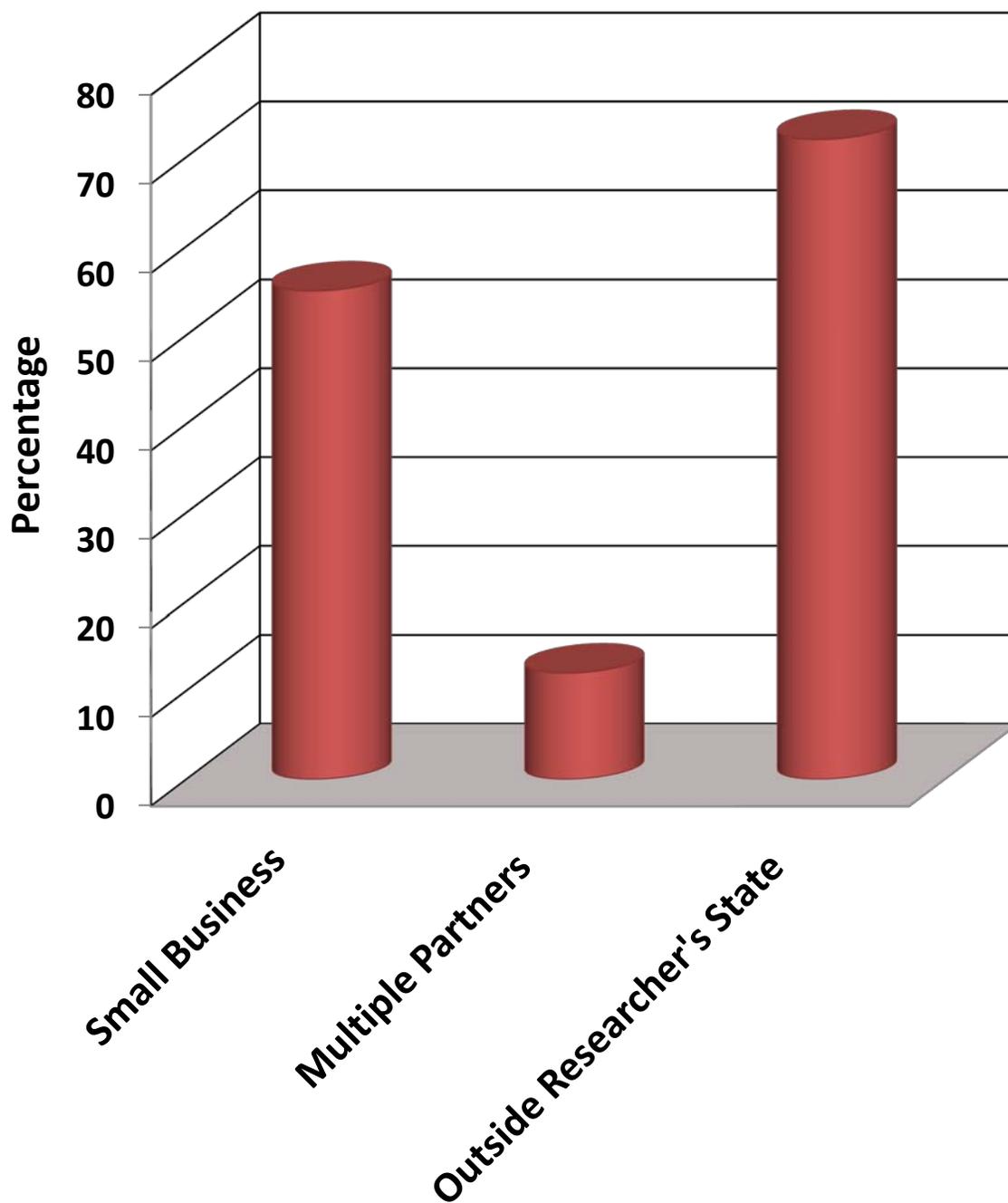


Figure 3. Percent of total of technology transfer agreements by type as executed in FY 2011.

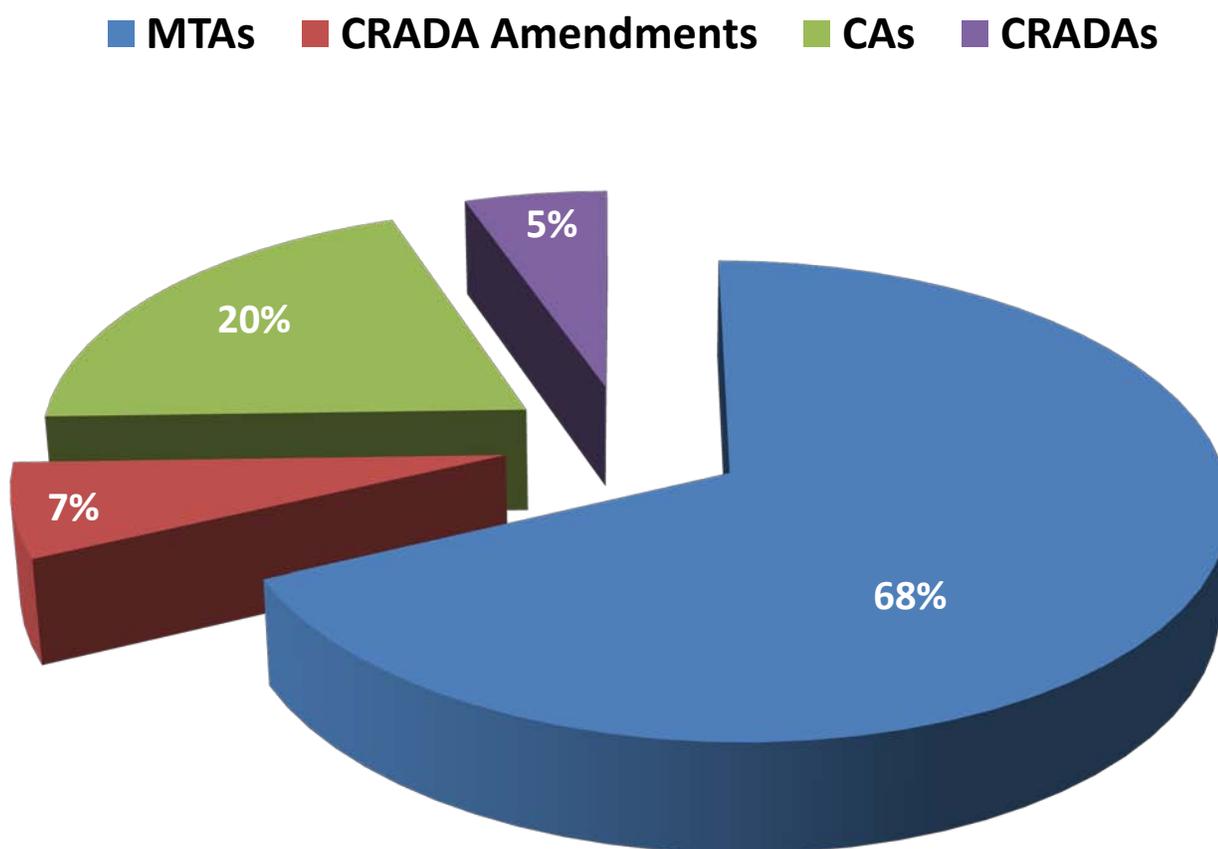


Figure 4. Invention disclosures, patent applications filed and patent issued for FY2007-FY 2011.

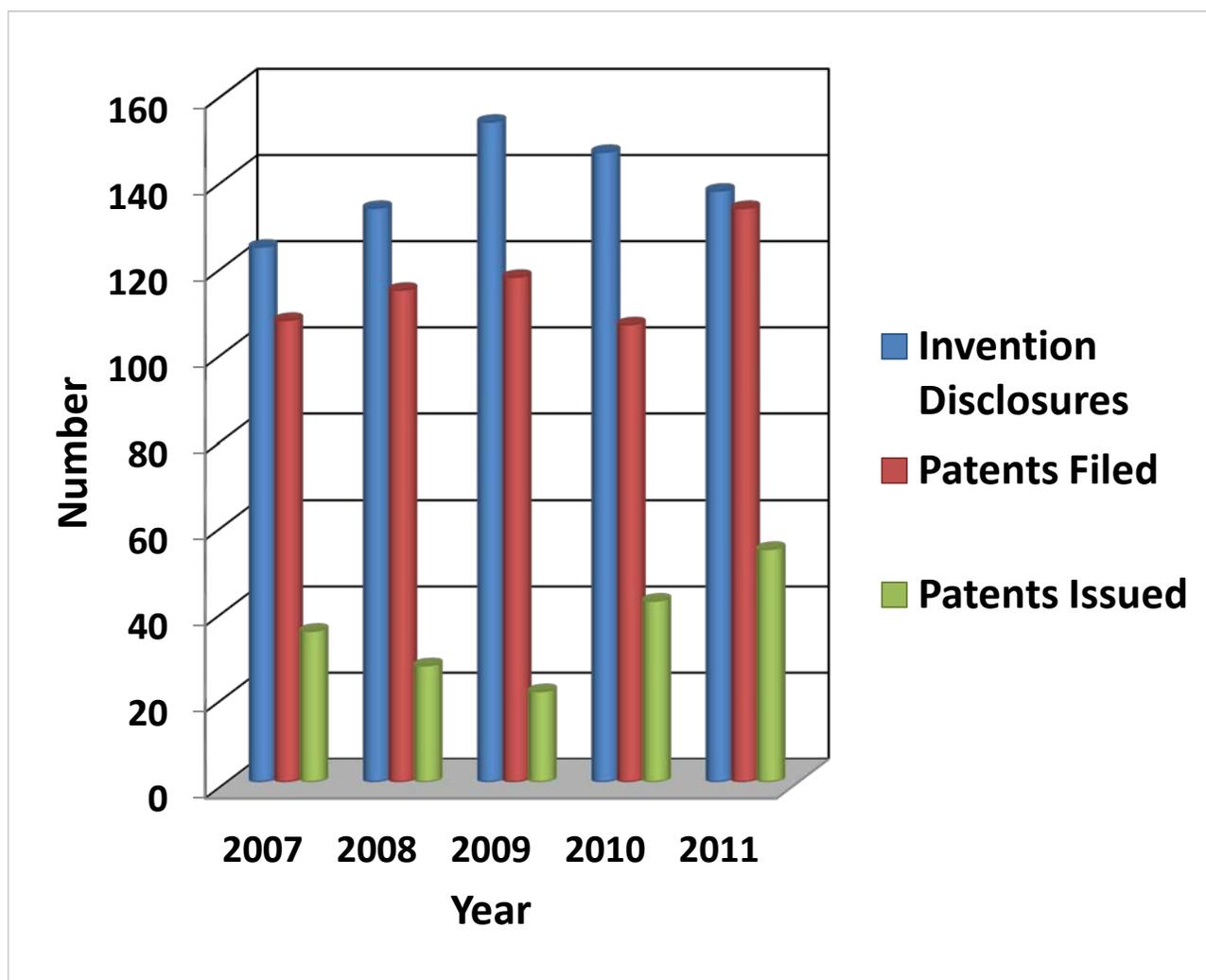


Figure 5. Percent of total of new licenses executed in FY 2011 by business type.

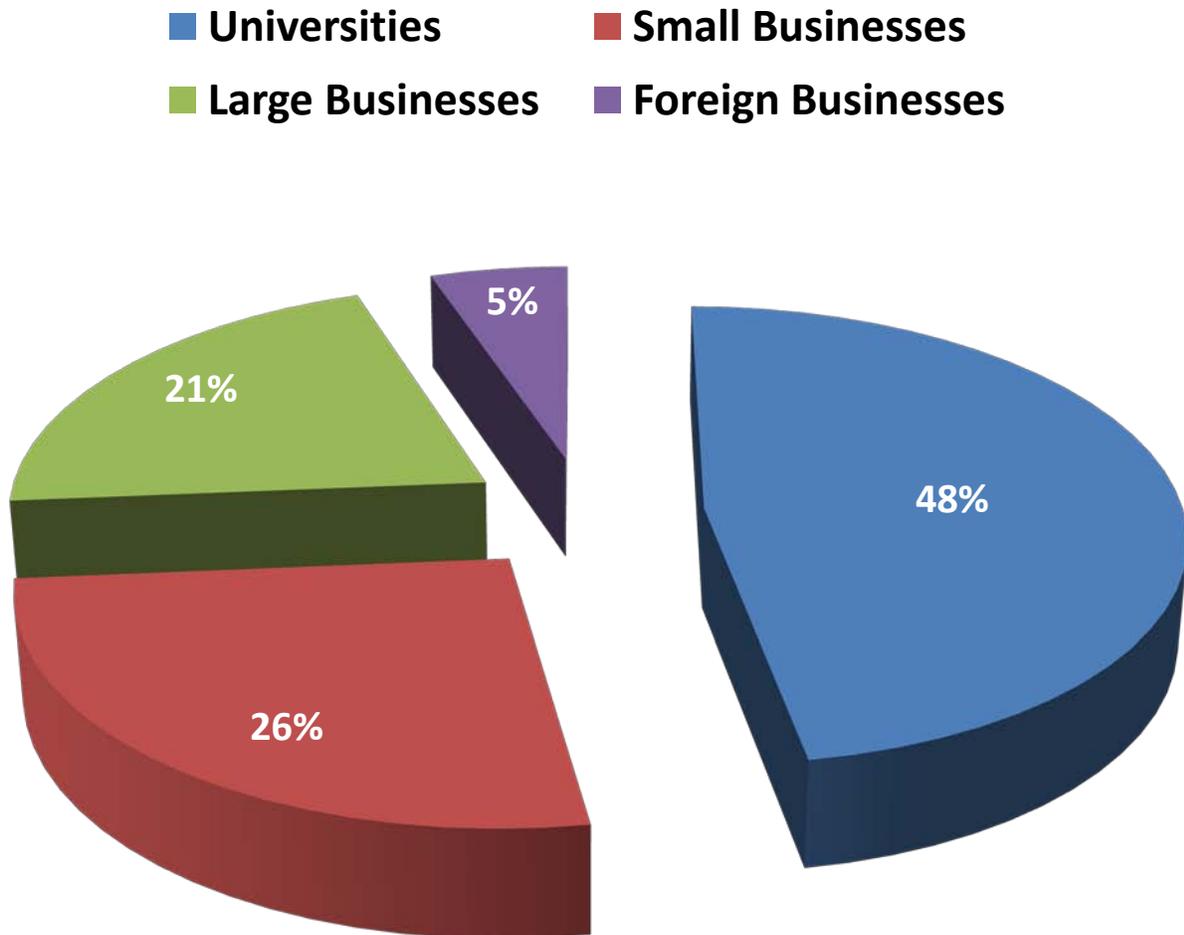


Figure 6. Number of Types of license agreements executed for FY2007-FY 2011.

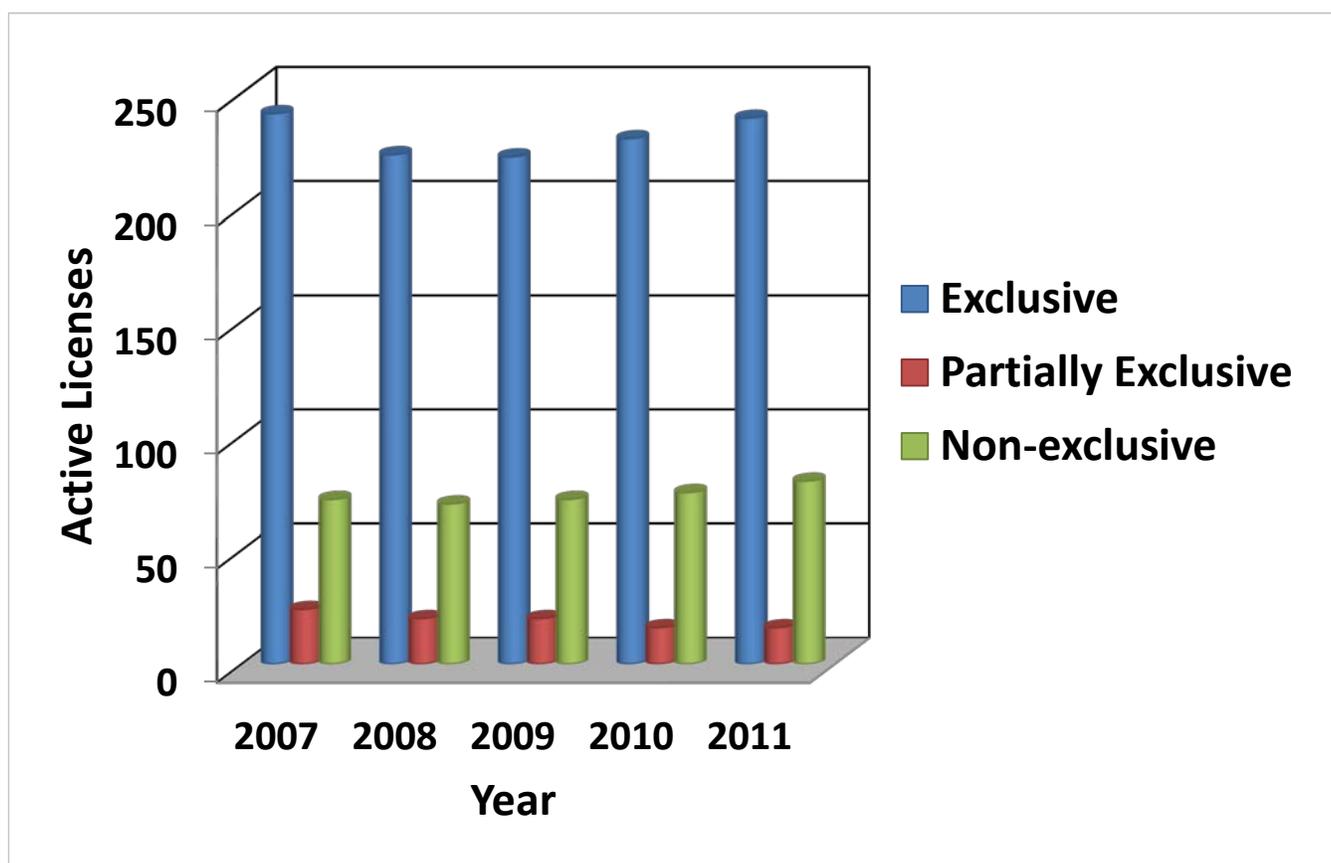


Figure 7. Number of ARS-approved publications for FY2007-FY2011.

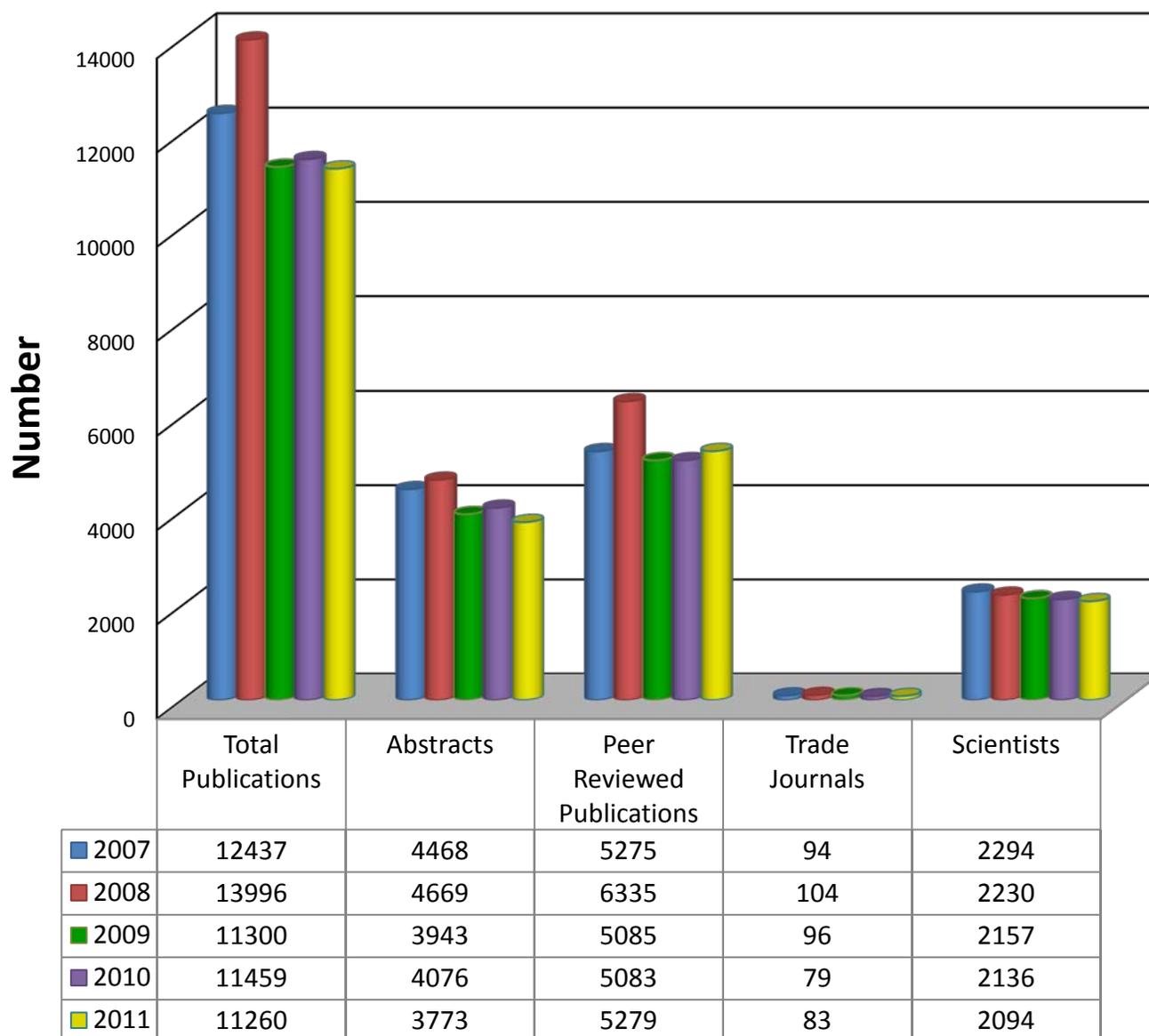


Figure 8. Number of peer reviewed publications and abstracts per scientist for FY2007-FY 2011.

