



U.S. DEPARTMENT OF AGRICULTURE
FY 2005 ANNUAL REPORTING ON
AGENCY TECHNOLOGY TRANSFER



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U.S. Department of Agriculture Annual Reporting on Agency Technology Transfer¹

Agricultural Research Service (ARS)

Mission Statement

ARS conducts research to develop and transfer solutions to agricultural problems of high national priority and provide 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 the natural resource base and the environment; and
- provide economic opportunities for rural citizens, communities, and society as a whole.

Structure & Culture

ARS is the U.S. Department of Agriculture's principal intramural scientific research agency. Agency goals are to find solutions to agricultural problems that affect Americans every day, from field to table, including (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, (f) keeping costs down for consumers, and (g) providing research support to other federal agencies.

ARS employs approximately 2200 permanent full-time scientists who conduct research in over 1200 projects (funded by Congressional appropriations) at over 100 locations. Research projects are grouped into 22 National Programs under the four broad pillars of Animal Production and Protection; Nutrition, Food Safety and Quality; Natural Resources and Sustainable Agricultural Systems; and Crop Production and Protection. The National Program Staff in Beltsville, MD coordinates the scope and objectives of Agency research projects, while eight Area Directors manage the research quality, and the facilities at the locations in their geographic areas. All research projects undergo a mandatory 5-year peer review and assessment cycle to meet the changing needs of customers and stakeholders. The Office of Scientific Quality Review convenes panels of industry and university scientists to review progress, evaluate the 5-year research proposal, and judge the qualifications and research capacities of the scientists and their laboratories. The process is designed to ensure quality, impact, and research relevance.

I. Agency Approach and Plans for Technology Transfer

Tech Transfer Principles, Modes, and Plans

ARS has been delegated authority by the Secretary of Agriculture to administer the patenting program for ARS, and the patent license programs for all intramural research conducted by the U.S. Department of Agriculture (USDA). ARS's Office of Technology Transfer (OTT) is assigned the

¹In response to the requirements identified for the annual "agency report on utilization" by 15 USC Sec. 3710 (f)(2).

responsibility for protecting intellectual property, developing strategic partnerships with outside organizations, and performing other appropriate activities that effectively transfer ARS technologies to the marketplace. The Patents Section of the USDA Office of General Council provides legal guidance.

ARS OTT is centralized in policy and approval procedures, and decentralized in development and implementation. To facilitate technology transfer, OTT is organized into five sections. The *Administrative/Headquarters Section* conducts day-to-day operations, coordinates technology transfer policy development, and executes licenses and Cooperative Research and Development Agreements (CRADAs). Patent advisors in the *Patent Section* assist scientists in protecting intellectual property (IP), coordinate invention reports, prepare and prosecute patent applications, and oversee any patent applications prepared by contract law firms. The *Licensing Section* negotiates licenses for IP developed by USDA scientists, principally from ARS, and monitors license performance. The *Marketing Section* develops, implements, and coordinates targeted marketing strategies to facilitate technology transfer, distributes information on ARS technologies that are available for licensing or cooperative partnerships, provides answers to stakeholder questions on technology transfer activities in ARS, and ensures information about ARS research commercial successes is available to the public. ARS has seven *Technology Transfer Coordinators* (TTCs) strategically stationed across the United States who are responsible for facilitating the development and transfer of USDA technologies. They serve as liaisons with scientists, ARS managers, university partners, and the private sector. They also negotiate CRADAs, other technology transfer agreements, and some licenses.

These objectives of technology transfer are accomplished through several mechanisms. These include written information—including reports to stakeholders, briefings, and other collateral materials—trade shows, technology showcases, meetings with industry organizations and universities, workshops, the ARS Information Staff, the National Agricultural Library, and electronic media.

Because our mission is to transfer technologies to the private sector for broad beneficial public use, we pursue patents and licensing only when IP protection facilitates technology transfer to the marketplace. This is usually the case when further research and development investment by the private sector is necessary to commercialize a product, and patent protection is required to protect this investment. ARS holds periodic patent review committee meetings to review invention disclosures and make recommendations to the Assistant Administrator on whether a patent is necessary and practical (sufficient scope, enforceable, appropriate for the size of the market, etc.).

Information on Agency Plans for Strengthening its Performance Metrics

Performance metrics in technology transfer often are difficult to define for research agencies where outcomes may not be reflected in counts of patents and licenses. For example, outcomes may be articulated in terms of improving existing agricultural practices, releasing scientific information that allows a business sector to enhance competitiveness, preventing introduction of disease through increased awareness and interception of pathogens, or in publishing negative findings that appropriately prevent corporations and universities from expending their resources in unproductive research efforts. Notwithstanding, USDA is continuing to work on defining better metrics with other federal research agencies under the guidance of the Interagency Working Group for Technology Transfer, convened monthly by the Office of Technology Policy, Department of Commerce.

In FY 2002, USDA recognized the need for a more sophisticated database to facilitate development and monitoring metrics in performing technology transfer. The passage of the Technology Transfer

Commercialization Act 2000 (P.L. 106-404) provided new authority for licensing unpatented, but “protectable,” technologies to private sector companies, yet ARS had no mechanism to catalogue and monitor such inventions. Additionally, the dynamics of global economies have created circumstances that may warrant protecting and licensing some plant technologies that traditionally have been placed in the public domain. ARS had no formalized process to evaluate such circumstances.

In response, the Office of Technology Transfer restructured the patent and licensing database modules of the Agricultural Research Information System (ARIS) to allow development of portfolios of “technology families.” The Invention Disclosure process for determining suitability for patenting was expanded by adding two new modules for assessing Plant Material Inventions, and Biological Material Inventions. Collectively, this improved database, with these disclosure forms, creates the infrastructure necessary to track technology transfer outcomes in these important new areas—regardless of whether formal intellectual property protection is sought. The restructured database was delivered to OTT in September 2003 (beta version). These new modules were evaluated, tested for data integrity, and further modified during FY 2005.

OTT began using the Biological Materials Inventions database for those inventions where private sector licensing was requested. This practice allows a refined process for documenting research outcomes. The Plant Material Invention module was beta tested in the summer of 2005, and went on-line for routine use November 1, 2005. This module provides a clear mechanism to review new plant materials to determine the merits of protecting and licensing the intellectual property, versus making a public release of new plants and varieties without intellectual property protection. Regardless of the decision, this module allows OTT to track research outcomes and document adoption by the private sector. We anticipate 80 submissions annually.

OTT also continues to explore other metrics demonstrating benefits to the public and USDA missions arising from technology research partnerships with universities, other not-for-profit organizations (e.g., commodity groups, commissions, and foundations), and private sector companies. We developed another new database module for Technology Transfer Coordinators (TTC module within ARIS) that captures outcomes involving transfer of knowledge and capabilities through transfer of research materials (Material Transfer Agreements), workshops, field days, scientific meetings, and working groups that assist customers and stakeholders in adopting ARS solutions to agricultural problems, or in furthering concepts developed by ARS. The TTC module was delivered to OTT (beta version) in the 3rd quarter of FY 2004 and became a routine component of our operation in FY 2005. In fact, this Annual Report includes information from this database; 722 MTAs were processed, including 523 for outgoing materials. This reflects research outcomes of interest to other non-ARS researchers and private sector companies.

All activities of the TTCs are now linked to the National Program (NP) project codes so that annual metrics can be obtained for each NP, and included in annual reports for the Government Performance and Results Act, the Project Assessment Rating Tool, and the Budget Performance Integration.

A third new module of ARIS, titled Extramural Tracking System, is under development and will provide a centralized database for other cooperative agreements (other than CRADAs) managed outside of OTT.

OTT continues to develop new ways and look for new opportunities to expand and improve upon its technology transfer activities. These include the following activities:

- Tradeshow attendance continues to be a part of OTT’s marketing strategy to diversify and reach new target customers. They are an effective outreach mechanism that allows us to measure our results immediately. The benefits of attending industry conferences and tradeshows are many.

Our goal continues to be to have an ARS-presence at major industry conferences to present technologies available for licensing and research partnering opportunities of interest to industry. Tradeshows are an important tool and a part of the total marketing mix used to get the word out about what ARS has to offer. They are a good way to build our customer base and make industry connections through face-to-face interactions with target groups. OTT alternates the types of tradeshows it attends each year. Shows are selected based on the types and number of technologies in a particular area needing commercial partnerships.

- The ARS-OTT Technology Alerts, developed and administered by the Marketing Section, continues to expand its membership. New members are sought through aggressive marketing strategies, which include word-of-mouth invitations to company officials at tradeshow events, meetings, letters, and personal interactions. Current list membership is more than 2255, up by over 200 from the previous year. The "Animal Production" list was divided into five subcategories in 2005. The entire list now includes: All Technologies; Animal Production Technologies; Swine Technologies; Cattle Technologies; Aquaculture Technologies; Poultry Technologies; Other Animals (every other animal, e.g. deer, sheep); Food, Safety and Nutrition Technologies; Biobased Technologies; Natural Resources Technologies; Biotechnology Technologies; and Crop Production Technologies. Plans for strengthening our service offerings in 2006 include expanding the Crop Production Technologies list into major agricultural commodities.
- ARS laboratories across the nation continue to plan workshops, meetings and seminars designed to inform industry representatives about ARS research findings. The meetings include presentations and instruction from ARS scientists, as well as demonstrations on specific projects. The topics often address major industry problems, for example, teaching the animal industry methods for controlling pathogens in livestock, or instructing the dairy and veterinary industry on using new dairy feeding guidelines. Many of these interactions result in dialogue between ARS researchers and industry, and often lead to formal collaborative research projects. Our survey conducted in 2004 revealed that the majority of our industry partnerships stemmed from contact with ARS scientists at meetings and workshops.
- OTT initiated a new training/workshop process designed to enhance adoption of research outcomes of specific National Programs where protecting intellectual property is essential. Although OTT personnel routinely visit research sites and conduct general training of scientists and line managers, we co-convened a workshop with scientists working in the Animal Health National Program with the purpose of tailoring OTT presentations to specific needs of animal health research. This was timed to provide specific training on transferring technologies to the private sector in the areas of vaccines, diagnostics and therapeutics; successful companies also presented on what they need from the ARS researchers. Following the workshop, scientists prepared their 5-year research project plans with specific goals of developing technologies for private sector commercialization. Annual metrics will monitor their success in developing and properly protecting these technologies. This approach will be applied to other National Programs in ARS where protecting intellectual property is more likely to enhance commercialization.
- The ARS research capacity is strategically positioned to help federal agencies meet preferred procurement of biobased technologies, as defined in the 2002 Farm Bill. To facilitate this, a Memorandum of Understanding was executed in mid-FY 2004 with TechLink at Montana State University. TechLink has a history with NASA and the Department of Defense (DoD) in providing assistance for both spin-out and spin-in technologies. During FY 2005, TechLink's interactions with ARS resulted in two CRADAs with small companies, and identification of a number of ARS projects that are producing biobased technologies of interest to DoD.

- OTT has created a Web-based intranet using Microsoft SharePoint to improve customer service by enhancing internal communications and efficiency. For example, all draft CRADA agreements are transmitted from field locations electronically to secure folders for final preparation, approvals, and signatures. The system also includes tracking and status of routing and approvals, so that metrics can be developed on the efficiency of our standard operating procedures. Metrics from the system can be used as a tool to identify areas where improvement can be achieved. This reduces execution time, allows for continuous improvement while also giving all technology transfer practitioners access to all CRADA documents from field locations. OTT is also in the process of converting all Invention Disclosure Review Committees to a paperless system, again using the secure connections of the intranet in SharePoint. This reduces costs of copying and shipping all confidential supporting documentation to each of the committee members who are distributed across the country. In addition to the cost savings, this process also allows “last minute” inclusions of supporting information, and facilitates electronic archiving of all deliberations and decisions.
- Beginning with FY 2006, the ARS OTT will expand its services to the USDA’s Animal and Plant Health Inspection Service, Wildlife Services (APHIS-WS), and future issues of this Annual Report will include sections on APHIS-WS. Research operations for APHIS-WS are centered in Ft. Collins, CO, at the National Wildlife Research Center where research activities focus on four major areas. These include Bird Research (e.g., hazards to aircraft, nonlethal repellents and attractants) Mammal Research (e.g., wildlife impacts on forest damage, predator ecology, behavior and management; rat damage to crops), Product Development Research (e.g., analytical chemistry, APHIS pesticide registrations and labels, wildlife damage management, immunocontraception and other fertility controls, Brown Treesnake), and Wildlife Disease Research (e.g., rabies and bovine tuberculosis, avian disease, chronic wasting disease, psuedorabies). OTT services will include incorporation of APHIS-WS technology transfer transactions into OTT relational databases; extensive training to APHIS-WS scientists; strategic planning and consultation in forming research partnerships with other federal scientists, universities, and private sector entities; management and monitoring of research agreements and Material Transfer Agreements; joint deliberations and recommendations on invention disclosures from APHIS scientists; patent application filing and prosecution for domestic and foreign patents; marketing services for seeking research partners and licensees for APHIS inventions; monitoring and reporting on metrics of APHIS technology transfer activities and downstream research outcomes.

II. Performance in the Last Fiscal Year: Activities and Outcomes

Collaborative Relationships for Research & Development (R&D)

CRADAs and Other R&D

	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
● CRADAs, total active in the FY	219	225	229	205	199
- New, executed in the FY	49	59	55	44	55
▪ Traditional CRADAs, total active in the FY	217	213	212	185	171
- New, executed in the FY	49	58	48	36	45
▪ Non-traditional CRADAs, total active in FY	2	10	17	20	28
- New, executed in the FY	0	1	10	8	11
▪ Material Transfer - CRADA, total active in the FY	2	3	6	4	6
- New, executed in the FY	0	1	4	0	3
▪ Master, total active in the FY	1	1	1	2	1
- New, executed in the FY	0	0	1	1	0
▪ Multiple Cooperators, total active in the FY	N/A	8	10	9	17
- New, executed in the FY	N/A	N/A	3	3	4
▪ Foreign - CRADA, total active in the FY	N/A	N/A	5	5	9
- New, executed in the FY	N/A	N/A	3	3	4
● Amendments¹, total in the FY		101	65	67	70
● Other collaborative R&D relationships, total active in the FY²	106	526	529	1,826	5,992
▪ Confidentiality Agreements					
- New, executed in the FY				162	242
▪ Material Transfer Agreements					
- New, executed in the FY	N/A	436	355	498	722 ³
▪ Other Agreements, total active in the FY ²	106	90	174	1,166	5,028
- New, executed in the FY	N/A	N/A	N/A	741	722

¹Amendments 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; data incomplete for FY 2001-2004.

³ Includes 523 processed for outgoing materials, representing research outcomes of interest to other researchers and private sector companies.

Invention Disclosure and Patenting

Intellectual Property Management

	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
● New invention disclosures in the FY	118	151	121	142	125
● Patent applications filed in the FY	83	90	60	81	88
▪ Non-Provisional		68	43	59	62
▪ Provisional		22	17	22	26
● Patents issued in the FY	64	53	64	50	27

Licensing

Profile of Active Licenses ¹

	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
● All licenses, number total active in the FY	255	267	270	296	320
▫ New, executed in the FY	32	26	27	29	33
▪ Invention licenses, total active in the FY	255	267	270	296	320
▫ New, executed in the FY	32	26	27	29	33
- Patent licenses, total active in FY	255	267	269	290	309
▫ New, executed in the FY	32	26	26	24	28
- Material transfer (invention), total active in FY	N/A	N/A	1	6	11
▫ New, executed in the FY	N/A	N/A	1 ²	5	5

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. Includes data from USDA, APHIS and USDA, Forest Service. Data for FY 2003 and FY 2004 was corrected for typographical errors.

² This represents USDA's first material transfer (invention) license.

Income Bearing Licenses¹

	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
• All income bearing licenses, number	241	265	268	294	318
▫ Exclusive	78 ²	179	183	200	220
▫ Partially exclusive	19 ²	37	41	41	37
▫ Non-exclusive	23 ²	49	44	53	61
• Invention licenses, income bearing	241	265	268	294	318
▫ Exclusive	78 ²	179	183	200	220
▫ Partially exclusive	19 ²	37	41	41	37
▫ Non-exclusive	23 ²	49	44	53	61
- Patent licenses, income bearing	241	265	267	288	307
▫ Exclusive	78 ²	179	183	200	220
▫ Partially exclusive	19 ²	37	41	41	37
▫ Non-exclusive	23 ²	49	43	47	50
- Material transfer (invention) licenses, income bearing	N/A	N/A	1	6	11
▫ Exclusive	N/A	N/A	0	0	0
▫ Partially exclusive	N/A	N/A	0	0	0
▫ Non-exclusive	N/A	N/A	1	6	11
• All royalty bearing licenses, number²	56	67	75	82	99
• Invention licenses, royalty bearing	56	67	75	82	99
- Patent licenses, royalty bearing	56	67	75	82	96
- Material transfer (invention) licenses, royalty bearing	N/A	N/A	0	1	3

¹ Includes data from USDA, APHIS and USDA, Forest Service. FY 2001 data does not include the USDA, Forest Service.

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

Licensing Management ¹

	FY 2001 ⁶	FY 2002 ⁵	FY 2003 ⁴	FY 2004 ³	FY 2005 ²
• Number of licenses					
▪ Invention licenses , total active in the FY	255	267	270	296	322
▫ New, executed in the FY	32	26	27	29	33
• Elapsed execution time , licenses granted in the FY					
▪ Invention licenses					
▫ average (months)	3.5	6.5	7.0	7.1	5.5
▫ median (months)	3.0	6.5	6.6	6.8	3.5
▫ minimum (months)	2.0	1.9	2.8	3.5	1.1
▫ maximum (months)	6.1	11.5	13.3	13.1	21.7
- Exclusive and partially exclusive invention licenses					
▫ average (months)	4.1	7.7	7.6	8.7	4.3
▫ median (months)	4.2	7.8	6.7	8.0	3.9
▫ minimum (months)	2.0	3.7	2.8	6.8	1.1
▫ maximum (months)	6.1	11.5	13.3	13.1	9.2
- Non-exclusive invention licenses					
▫ average (months)	2.1	5.3	5.9	6.2	6.8
▫ median (months)	2.1	5.3	5.8	6.0	2.9
▫ minimum (months)	1.9	1.9	3.5	3.5	1.7
▫ maximum (months)	3.7	9.0	9.9	11.5	21.7
▪ Patent invention licenses					
▫ average (months)	3.5	6.5	7.1	8.2	6.1
▫ median (months)	3.0	6.5	6.6	7.5	3.9
▫ minimum (months)	2.0	1.9	2.8	3.5	1.1
▫ maximum (months)	6.1	11.5	13.3	13.1	21.7
- Exclusive and partially exclusive patent invention licenses					
▫ average (months)	4.1	7.7	7.6	8.7	4.3
▫ median (months)	4.2	7.8	6.7	8.0	3.9
▫ minimum (months)	2.0	3.7	2.8	6.8	1.1
▫ maximum (months)	6.1	11.5	13.3	13.1	9.2
- Non-exclusive patent invention licenses					
▫ average (months)	2.1	5.3	6.1	7.8	8.6
▫ median (months)	2.1	5.3	6.6	7.1	5.8
▫ minimum (months)	1.9	1.9	3.5	3.5	2.6
▫ maximum (months)	3.7	9.0	9.9	11.5	21.7
▪ Material transfer (invention) licenses					
▫ average (months)	N/A	N/A	5.0	4.4	2.3
▫ median (months)	N/A	N/A	5.0	4.0	2.3
▫ minimum (months)	N/A	N/A	5.0	3.6	1.7
▫ maximum (months)	N/A	N/A	5.0	6.0	2.9
- Non-exclusive material transfer (invention) licenses					
▫ average (months)	N/A	N/A	5.0	4.4	2.3
▫ median (months)	N/A	N/A	5.0	4.0	2.3
▫ minimum (months)	N/A	N/A	5.0	3.6	1.7
▫ maximum (months)	N/A	N/A	5.0	6.0	2.9
• Licenses terminated for cause , in the FY					
▪ Invention licenses	1	3	0	1	0
▪ Patent invention licenses	1	3	0	1	0
▪ Material transfer (invention) licenses	N/A	N/A	0	0	0

Footnotes for Licensing Management Table

¹ During FY 2005, USDA, ARS received 30 new invention license applications, for which 7 new licenses were granted. Of the remaining 23 applications, 3 applications were withdrawn by the applicants, 13 license agreements are currently in negotiation, and 7 applications are on hold by request of the applicants.

² Based upon 14 licenses granted to commercial licensees. FY 2005 data does not include the elapsed execution time (29.4 months) for a license granted to a commercial co-owner who delayed the company's decision to license USDA's rights in the licensed invention. The elapsed execution time data presented also does not include licenses executed with universities for co-owned inventions. In accordance with 35 USC 202(e), such licenses are granted for the purpose of consolidating rights in the invention, and therefore a license application is not required.

³ Based on 17 licenses granted. The elapsed execution time data presented does not include licenses executed with universities for co-owned inventions. In accordance with 35 USC 202(e), such licenses are granted for the purpose of consolidating rights in the invention, and therefore a license application is not required. Records for which license applications were received prior to October 1, 2000 also were not included, because ARS did not track this data prior to FY 2001.

⁴ Based on 16 licenses granted. The elapsed execution time data presented does not include licenses executed with universities for co-owned inventions. In accordance with 35 USC 202 (e), such licenses are granted for the purpose of consolidating rights in the invention, and therefore a license application is not required. Records for which license applications were received prior to October 1, 2000 also were not included, because ARS did not track this data prior to FY 2001.

⁵ Based on 12 licenses granted. The elapsed execution time data presented does not include licenses executed with universities for co-owned inventions. In accordance with 35 USC 202 (e), such licenses are granted for the purpose of consolidating rights in the invention, and therefore a license application is not required. Records for which license applications were received prior to October 1, 2000 also were not included, because ARS did not track this data prior to FY 2001.

⁶ FY 2001 data included only 6 records because ARS did not begin tracking this data until October 1, 2000. Records for which license applications were received prior to this date were not included. FY 2001 data do not include the USDA, Forest Service.

License Income ¹

	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
• Total income, all patent invention licenses active in the FY	\$2,622,000	\$2,571,378	\$2,290,903	\$2,163,507	\$3,315,486
▪ Invention licenses	\$2,622,000	\$2,571,378	\$2,290,903	\$2,163,507	\$3,315,486
- Patent licenses	\$2,622,000	\$2,571,378	\$2,290,903	\$2,140,466	\$3,302,371
- Material transfer (invention licenses)				\$23,041	\$13,115
• Total Earned Royalty Income (ERI)	\$1,409,252	\$1,569,877	\$1,560,825	\$1,426,876	\$2,089,174
- Patent (and patent application) licenses, total ERI	\$1,409,252	\$1,569,877	\$1,560,825	\$1,423,835	\$2,083,059
▫ Median ERI	\$5,723	\$5,096	\$3,102	\$5,645	\$5,601
▫ Minimum ERI	\$78	\$79	\$159	\$124	\$49
▫ Maximum ERI	\$563,320	\$569,265	\$236,306	\$154,213	\$263,648
▫ ERI from top 1% of licenses	Not presented ²	Not presented ²	Not presented ²	Not presented ²	Not presented ²
▫ ERI from top 5% of licenses	\$723,167	\$794,418	\$696,532	\$499,709	\$890,414
▫ ERI from top 20% of licenses	\$1,109,051	\$1,254,545	\$1,292,383	\$1,026,141	\$1,624,258
- Material transfer (invention licenses), total ERI	N/A	N/A	\$0	\$3,041	\$6,115
▫ Median ERI	N/A	N/A	\$0	\$3,041	\$1,925
▫ Minimum ERI	N/A	N/A	\$0	\$3,041	\$600
▫ Maximum ERI	N/A	N/A	\$0	\$3,041	\$3,591
▫ ERI from top 1% of licenses	N/A	N/A	\$0	\$3,041	\$3,591
▫ ERI from top 5% of licenses	N/A	N/A	\$0	\$3,041	\$3,591
▫ ERI from top 20% of licenses	N/A	N/A	\$0	\$3,041	\$3,591

¹ Includes data from USDA, APHIS and USDA, Forest Service. FY 2001 data does not include the USDA, Forest Service.

² Represents a single license.

Disposition of License Income ¹

	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
• Income distributed²					
▪ Patent Invention licenses, total distributed	\$2,621,900	\$2,463,240	\$2,586,583	\$2,274,043	\$2,661,184
- To inventors	\$681,700	\$543,336	\$540,399	\$380,916	\$821,677
- Salaries of some technology transfer staff	\$1,075,000	\$1,102,891	\$1,156,936	\$1,265,991	\$1,221,246
- Patent filing preparation, fees, and patent annuity payments	\$707,900	\$686,696	\$785,218	\$627,136	\$618,261
- Other technology transfer expenses	\$157,300	\$130,317	\$104,030	\$0	\$0
▪ Material transfer (invention) licenses, total distributed	N/A	N/A	\$0	\$23,022	\$14,556
- To inventors	N/A	N/A	\$0	\$9,011	\$9,698
- Salaries of some technology transfer staff	N/A	N/A	\$0	\$14,011	\$4,858
- Patent filing preparation, fees, and patent annuity payments	N/A	N/A	\$0	\$0	\$0
- Other technology transfer expenses	N/A	N/A	\$0	\$0	\$0

¹ Includes data from USDA, APHIS and USDA, Forest Service. FY 2001 data does not include the USDA, Forest Service.

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

Downstream Outcomes from Technology Transfer Activities

Selected examples of Technology Transfer Outcomes in FY 2005:

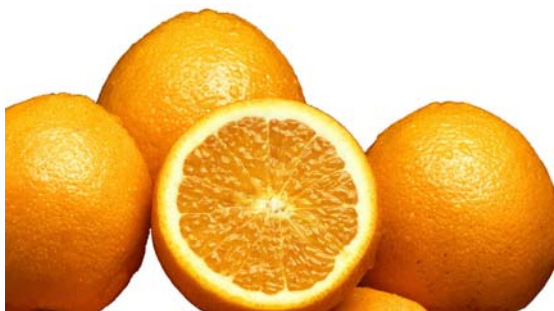


Defending Against Bird Flu Diseases in the United States.

Researchers at ARS's Southeast Poultry Research Laboratory in Athens, GA, have developed a real-time Polymerase Chain Reaction (PCR) test to diagnose avian influenza or bird flu as it is commonly called—including the H5N1 strain. Bird flu is an infection caused by avian influenza viruses. These flu viruses occur naturally among birds, and are very contagious among them. This highly pathogenic virus has the potential to turn into a worldwide problem. The World Health Organization reports that “from mid-December 2003 through early February 2004, poultry outbreaks caused by the H5N1 virus were

reported in eight Asian nations...most of these countries had never before experienced an outbreak of highly pathogenic avian influenza in their histories.”

ARS's new diagnostic tool gives the user an answer in three hours. It is now the first line test run on poultry samples suspected of avian influenza, and is the official test used by the National Veterinary Services Laboratories (APHIS) and National Animal Health Laboratory Network. ARS poultry disease experts spent this past year improving and developing dried-down reagents that have long shelf life and improved availability. This technology reduces possible contamination for reagents made in each laboratory. In addition, the researchers developed heat treatment standards for pasteurizing egg and meat products to kill avian influenza virus. USDA's Food Safety and Inspection Service and the Food and Drug Administration use these standards in developing their regulatory guidelines.



Protecting Our Nation's Citrus Industry Against Citrus Greening Disease.

Researchers with ARS's Fruit Lab in Beltsville, MD, in cooperation APHIS, recently developed the first quantitative and real time PCR-based assay for the pathogen that causes huanglongbing (also called citrus greening or yellow dragon disease). The vector that transmits this threatening citrus fruit disease has been present in Florida since 1998. Now, the citrus industry is in danger, because an Asian strain of the disease was found in Florida in September 2005. The disease has since been

found to be widespread in Florida. This disease poses a serious threat to the entire U.S. citrus industry as well, because the vector insect is also present in Texas. There is no cure for the disease, and no effective control once a tree is infected—other than tree removal.

The disease is expected to have a severe impact on the citrus industry. ARS researchers and their colleagues from APHIS have shared the technology with the Florida Dept of Agriculture for use in their current survey efforts directed against this pathogen in Florida. This new assay can unambiguously identify and quantify the pathogen in a plant sample in 40 minutes (or approximately two hours counting extraction time for the sample). Also, since the pathogen has not been cultured in the lab, it is the only method available to provide any quantitative measurement of the number of pathogenic bacteria present in any grove or research sample.



Shielding Soybean Crops Against Rust Disease. Soybean rust is an important disease in most soybean-growing regions throughout the world, causing significant yield losses. In November 2004, soybean rust was found in the United States for the first time, and since then has spread to nine states. ARS researchers performed research that helped soybean farmers better prepare for the introduction of soybean rust into the United States. The researchers developed a PCR diagnostic assay that can identify and differentiate between the two *Phakopsora* species that cause soybean rust. The PCR assay, developed at ARS's Foreign Disease-Weed Science Research Unit in Fort Detrick, MD, has been used to determine the presence of soybean rust in South Africa, Brazil, and Paraguay. It was also used to confirm the presence of the Asian strain of soybean rust in nine states in the continental United States. ARS scientists conducted several training workshops on soybean rust identification and PCR identification for plant disease diagnosticians from the five

Regional Plant Disease Diagnostic Centers, as well as for members of the NC-504 committee on soybean rust. In 2005, the assay was validated and deployed at four of USDA's Cooperative State Research, Education and Extension Service National Plant Diagnostic Network hub laboratories located at land grant universities in New York (Cornell), Michigan (Michigan State University), Florida (University of Florida) and Kansas (Kansas State University).

Assessing Human Nutrition and Diet. ARS researchers envisioned a novel approach to capturing and evaluating personal food and nutrition information. Their vision has materialized into NESSy (Nutrition Evaluation Scale System), an interactive diet and nutrition tool. NESSy is a series of programs nutritionists, consumers, and researchers can use to precisely measure food intake, and nutritional and caloric content of foods. ARS nutritionists created this system before the public, and even the nutrition research community, appreciated its potential.



Initial work on NESSy started under a Cooperative Research and Development Agreement (CRADA) with a private foundation interested in nutrition and healthcare. This CRADA focused on developing hardware and software updates essential for NESSy's ultimate marketability. ARS established a new CRADA with Princeton Multimedia Technologies Inc. (now known as Viocare Inc.), Princeton, NJ, a software and engineering firm interested in human nutrition products, to further develop the system.



ARS patented the technology, and licensed it to Princeton. Three products resulted from the original NESSy patent—Professional NESSy (ProNESSy), Consumer NESSy, and Internet NESSy (iNESSy).

ProNESSy is a hardware-software tool used by dietetic and healthcare professionals; where as Consumer NESSy is designed for consumers. ProNESSy sales began in fall 2003. ProNESSy assists professionals in accurately tracking and evaluating food intakes for multiple research

subjects in clinical, metabolic, and other research studies. Consumer NESSy, designed for a handheld computer, offers consumers a way to precisely measure their food intake, and aids them in understanding caloric and nutrient intake from the foods they eat.

Princeton Multimedia received a highly competitive SBIR grant from The National Institutes of Health (NIH), National Heart Lung and Blood Institute, to develop Internet NESSy (iNESSy). iNESSy is designed to educate the American public on appropriate food portions for body weight control. All three NESSy products should play an import role in addressing American's obesity and health concerns.

Keeping Our Water Supply Clean. ARS researchers have developed several computer models that can be used to manage and improve our nation's watersheds and streams. ARS scientists have developed new innovative tools to assess nitrogen management and nitrate leaching to increase farm profitability and reduce non-point source water pollution. ARS scientists developed the Nitrate Leaching and Economic Analysis Package (NLEAP) computer model and book (Managing Nitrogen for Groundwater Quality and Farm Profitability). NRCS and others are currently using this tool across the globe to reduce nitrogen leaching. Using the Revised Universal Soil Loss Equation and other ARS-developed state-of-the-art computer models, researchers at the ARS National Sediment Laboratory in Oxford, MS, have engineered an integrated approach to assessing impacts of watershed-management practices within conservation programs.



Two of the models being used in the program are the Annualized Agricultural Non-Point Source (AnnAGNPS) model and the Conservational Channel Evolution and Pollutant System (CONCEPTS) model. AnnAGNPS predicts soil erosion and nutrient transport/loadings from agricultural watersheds for real or hypothetical storms. While CONCEPTS evaluates the long-term impact of rehabilitation measures to stabilize stream systems and reduce sediment yield. CONCEPTS can predict the dynamic response of flow and sediment transport to in-stream hydraulic structures. It computes channel evolution by tracking bed elevation changes and channel widening. This work enhances understanding of how watershed-scale assessments capture impacts at multiple scales, and what the effects of soil conservation practices are beyond the farm.

SWAT (Soil and Water Assessment Tool) is a computer model that tells where in a watershed a water pollution problem is coming from and what to do about it. A team of researchers at the ARS Grassland Soil and Water Research Laboratory in Temple, TX, developed this model. Scientists and engineers with NRCS and the Texas Agricultural Experiment Station are using the model to analyze watersheds across the nation as part of the USDA Conservation Effects Assessment Project (CEAP) to quantify the benefits of USDA conservation programs in improving the quality of water across the nation. The U.S. Environmental Protection Agency is using SWAT to help determine the status and health of the nation's rivers and streams through its Total Maximum Daily Loads (TMDL) activity. Many people in the United States and around the world have directly benefitted from this technology by way of a longer lasting and less costly water supply due to reduced sedimentation in reservoirs.

Controlling Orchard Pests Naturally. The codling moth (CM) is more harmful than docile. Larvae of this orchard pest can destroy up to 95 percent of an apple crop and up to 60 percent of a pear or walnut crop. It is the major pest of apples, pears, and walnuts worldwide—causing severe crop damage and substantial economic loss. Current control measures include large amounts of insecticide. ARS researchers discovered pear ester is highly attractive to codling moths— attracting both males and females. It is non-attractive and non-disruptive to beneficial insect parasitoids and predators—natural enemies of CM. Two ARS entomologists, recognizing the importance of their discovery, developed a kairomone (a plant chemical that attracts insects) that is proving to be highly useful and beneficial to industry. The researchers partnered with Trécé, Inc., of Adair, OK, under a CRADA to fully develop the monitoring and control capabilities of ARS's codling moth kairomone.



Traditionally, only sex pheromone lures attractive to males were available—thus limiting population assessment. Detecting and estimating female moths' mating and egg-laying behaviors are more valuable for effective monitoring. Since 2001, ARS's pear ester kairomone lure has improved accuracy

and precision of population monitoring. This has improved the timing and effectiveness of insecticide sprays, critical to killing hatching larvae before they escape.



A second lure, which is a combination of a pheromone and the pear ester kairomone, was commercialized in 2004. This product is more effective in attracting CM than the pear ester alone. Researchers, extension advisors, private consultant practitioners (pest control advisors), and growers worldwide are now using these two lures. They are being used for monitoring thousands of acres worldwide. This work has resulted in a revolutionary change in monitoring and control strategies for codling moth. Two U.S. patents have been granted on the technology, covering both attractants, methods and formulations, which Trécé has licensed. Foreign patent rights have also been issued in some countries, and are being pursued in others.



Improving the Quality of U.S. Beef. ARS researchers have a passion for ensuring top quality beef makes it to the tables of consumers across the nation. Their latest development is software that can be used to simulate a variety of breeding scenarios that will maximize a farmer's economic potential—thus providing quality beef to consumers. The software is highly effective, practical, and can be used by a variety of end-users.

ARS researchers have determined relative economic values for a variety of reproductive, maternal, growth, and carcass traits for general purpose cattle populations and specialized breeding lines. These values make up breeding objectives currently used by the American Hereford Association, North American Limousin Foundation, American Simmental Association, American International Charolais Association, Circle A Angus Sire Alliance, and Beefbooster Cattle, Ltd. Selection index calculations from the model are available to beef producers via the breed association Websites, with over one million animals being evaluated in 2005. The American Hereford Association was first to roll out selection indexes, explicitly based on ARS's model, in January 2005. A considerable number of breed associations have adopted, and now rely fully on the technology, as well as numerous selection programs. Numerous breeding animals are managed in accordance with the program.



ARS has received more than 25 invitations to speak on the topic of multiple trait selection for genetic improvement at meetings in the United States, Canada, China, and South Africa. As a result of demonstration efforts with Beefbooster, Circle A, and the American International Charolais Association, several national breed associations have adopted the technology.



Saving the Date Industry. The California Date Commission and the Board of Directors of Coachella Valley Natural Resources Conservation District requested ARS's assistance to help save the 7,000 acres of California dates—estimated at an annual value of \$65 million. Several years ago growers began to notice a large number of date trees exhibiting continuous decline in vigor, accompanied by reduced yield and fruit quality. These trees could not be revived even when given more water and fertilizer.

In collaboration with the USDA Natural Resources Conservation Service (NRCS), ARS researchers discovered the primary problem was due to soil stratification, which impeded water and nutrient

movement. Secondary problems contributing to date decline included soil compaction by mechanical farm operations, high soil salinity due to poor drainage, and extremely low soil fertility. In addition, poor water infiltration resulted in stagnant water remaining on the soil's surface for several days following irrigation, thus serving as mosquito-breeding grounds.

ARS proposed two solutions. The first was using slip plowing—an operation that fractures stratified layers (primary cause) and mixes them with the soil to allow water and nutrient movement. The second solution involved implementing a no-tillage cover cropping system to prevent soil re-compaction. These solutions helped reduce farming operations, eliminated soil stratification and compaction, improved water and fertilizer use efficiency, eliminated conditions that supported mosquito breeding, and provided organic matter and nutrients.

The technology helped fill an important agricultural need, because many of the orchards were not generating any economic return due to low yield and poor fruit quality. Also, this problem arose at a time when U.S. growers were facing strong competition by date growers in North Africa and the Persian Gulf countries. These date orchards represent the only area where dates are produced in the entire United States. ARS helped saved this industry from a unique problem that has never been encountered in other date-growing regions of the world.

As result of ARS's research, average date yields increased by 12 percent and fruit quality improved by 10-15 percent, while production cost was reduced by \$100/acre. The value of date farmers' land has increased significantly due to added fertility. Within a short time from introducing the new technology about 45 percent of date acreage is using ARS's technology.



ARS's strategies were so successful with the date industry that Coachella Valley table-grape growers, who farm over 14,000 acres with an estimated market-worth of \$135 million annually, were also interested in adopting them. With help and guidance from ARS and NRCS researchers, the table-grape growers modified their grape production system, which resulted in savings of approximately \$28 million per year for grape production. Now, over 45 percent of the vineyards in the Valley are using the new technology. This number is increasing annually, which will result in further savings to the grape industry.

This technology received a regional Federal Laboratory Consortium award.



Protecting Catfish Health. ARS researchers developed two modified live vaccines to prevent *enteric septicemia* and *columnaris*—major diseases in channel catfish. Both diseases together cost the U.S. catfish industry \$50-70 million annually. In 2003 alone, the catfish industry reported the diseases in about 50 percent of all catfish operations. These pathogens are responsible for severe disease outbreaks throughout the catfish industry every year. The two diseases are caused by *Edwardsiella ictalari* (*E. ictaluri*) and *Flavobacterium columnare* (*F. columnare*), two bacterial pathogens that infect catfish of all sizes. Previous studies suggested that killed vaccines against both *E. ictaluri* and *F. columnare* were not effective when administered by immersions at the hatchery (i.e. mass immunization). ARS researchers modified both bacteria, preventing bacteria that may come into contact with

fish from infecting the fish and causing disease. The researchers used this to create a modified live vaccine, eliminating many of the problems associated with killed vaccines—need for injecting each fish, high cost of administering a vaccine, stress to the fish, and lack of lifetime protection.

The ARS-developed vaccines are administered by bath at seven days post hatch to prevent disease losses. This technique allows producers to treat large numbers of young fish, and also provides lifetime protection. Both vaccines were developed under a CRADA with Intervet, Inc., of Millsboro, DE, and are exclusively licensed to Intervet. The *enteric septicemia* vaccine (AQUAVAC-ESC™) was first introduced in 2001. According to Intervet, total benefit to producers from using this vaccine alone is almost \$2,000 per acre. This savings is due to improved fish survival and faster growing catfish, which yield greater lengths over non-vaccinated catfish. Since the release of AQUAVAC-ESC™ almost one billion fish fry have been vaccinated. The *columnaris* vaccine (AQUAVAC-COL™), the first effective vaccine against *columnaris* disease in the world, was launched in 2005 and production is sold out.

These two vaccines are a trend-setting advancement in fish vaccinology. Used in combination, they provide fish farmers a cost effective means for preventing the two most economically serious diseases in commercial pond-raised catfish. In addition, these vaccines significantly reduce the need for antibiotics thus decreasing environmental contamination, and providing a safe fish product for consumers. Fry production is about one billion a year and some 25 percent are vaccinated with one or both vaccines. With about 180,000 acres of commercial catfish ponds, the potential economic benefit of these vaccines to farmers approaches \$50 million annually.



Developing Future Cotton Ginners. One of the most important technology transfer methods at ARS is disseminating research-based knowledge to our customers and stakeholders. One unique mechanism ARS researchers use to accomplish this is through the Cotton Ginner Schools. Gin schools are conducted at each of the USDA-ARS ginning research laboratories in Stoneville, MS; Lubbock, TX; and Mesilla Park, NM. ARS cotton ginning labs work closely with the National Cotton Ginners Association and other regional cotton ginners associations to conduct these successful and informative training programs.



The first Cotton Ginner School was conducted in 1986, with nearly 100 attendees. A few years after the first school opening, two additional schools followed. The course curriculum has evolved into four levels of instruction, including an advanced instruction level.

In 1991, school leaders and the National Cotton Ginners Association established a Cotton Ginners Certification Program that combines school participation and practical experience in the gin. By the summer of 1992, the Cotton Ginner Certification Program had 39 participants. Today, there are over 500 ginners that have met the stringent certification requirements.

The schools have brought the basics of gin operation, maintenance, and safety to over 7,210 students. Spring 2005 marked 20 years for the Cotton Ginner School. The schools help our researchers identify problems and issues facing commercial ginners. Although it is difficult to document, the safety training that is provided at the schools can be credited with preventing many injuries, and possibly deaths, to gin employees through proper training.

Recognizing a need to strengthen its connections with cotton ginners and the cotton industry, ARS created a Cotton Technology Transfer and Extension Coordinator (CTTEC) position jointly funded by ARS and CSREES. This person is the first point-of-contact for those in the cotton industry to find out what new research projects and information technology is taking place at ARS labs. The CTTEC holds regular meetings and develops publications to inform cotton producers and ginners of the latest technological advancements.

Improving Melon Quality. ARS researchers have developed technology that improves the quality of melons, like cantaloupe, honeydew, or muskmelon. The technology is a treatment that can be sprayed on melon fruits on the vine. The treatment improves postharvest fruit exterior and interior firmness, marketability, disease resistance, calcium concentration, sugar content, and consumer acceptance. It uses several different organic calcium treatments at varying levels. Calcium concentration in the rind and in edible tissue portions increases during melon fruit development, but rapidly declines in postharvest fruit ripening. Postharvest baths are unsuitable for melons grown in the desert southwestern United States, or other low-humidity melon-growing regions of the world, because growers box melons in the field at harvest for shipment. ARS's treatment is ideal, since the fruit is treated on the vine.



ARS researchers, through a cooperative agreement, worked with Albion Advance Nutrition laboratories and the California Melon Board to develop a technique allowing commercial melon growers to spray fruit on the vine, at discrete stages of fruit development, with an organic calcium treatment. This technique provides melon growers with a technology that improves fruit quality—offering a better consumer product and increased profitability for growers.

Organic calcium sales at Albion Advanced Nutrition increased, from 28,012 gallons to 69,210 by the end of 2004, and sales are expected to increase to 78,710 gallons by the end of 2005. Agrochemical distributors in turn have grossed over \$1,000,000 additional dollars per year from application of this technology. An additional 160,000 acres, worldwide, are using this technology. The grower is earning an estimated additional \$100 per acre, and in some cases farmers have grossed an additional \$3,000 per acre. At \$100 extra per acre, the industry net impact is a \$16,000,000 increase in earnings a year. This does not include added savings due to increased shelf life resulting in less waste and more fruit being sold at the retail level.

Shelf life and quality in the melon industry have greatly increased because of this technology. Many growers and researchers have extended this technology to other fruits and vegetable crops—with similar positive results. The consumer is ultimately benefiting from better quality fruit at the marketplace.



Cotton Ginning Technology. Cotton gins are essential in separating seed and fiber from cotton. They also clean and package cotton fiber for future processing by textile mills. Typically 8 to 15 pounds of lint is wasted in the cleaning process. To help prevent this waste and improve cotton producers' profitability, researchers at the ARS Cotton Ginning Laboratory in Stoneville, MS, developed a louvered lint cleaner, which significantly reduces the amount of wasted fiber without harming fiber quality. This technology can be used to automatically select the optimum number of cleaning points in conventional saw-type lint cleaners, without stopping the lint flow. Developing novel engineering methods to ensure the louver could not contact the saw during operation was important to the success of this technology. If this adjustment is done manually, an hour or

more of downtime is required per lint cleaner—gins typically have 3 to 12 lint cleaners. This technology was patented in 1999 and exclusively licensed to Continental Eagle in 2001. Known as the LOUVERMAX™ Lint Cleaner, 23 of these systems are in use commercially.

The LOUVERMAX™ allows “prescription” processing of individual lots of cotton based on their specific characteristics, and the needs of the cotton marketing system—reducing a loss in market value. Field demonstrations of LOUVERMAX™ have shown bale weight increases of about 10 pounds each (\$6 to \$7) on 50 to 80 percent of the bales ginned.



Bleeding Mice Humanely. ARS researchers, in collaboration with, MEDIpont, Inc., Mineola, NY, developed a new lancet that advances more humane treatment of laboratory animals. Goldenrod™ named for the inventors, is a non-invasive tool used to draw blood from laboratory mice. The primary method used in the United States is retro-orbital (eye) bleeding. Alternatively, bleeding by clipping off the end of the tail is another method, but yields a very limited amount of blood. Both of these invasive methods are not useful when multiple samples are required from the same animal. Other bleeding methods, again, may be more cumbersome and impractical for multiple samples. Mice are used for most

cancer, sexually transmitted disease, and pharmaceutical research. These animals, and subsequent bleeding techniques, are critical to finding clues and solutions to human medical mysteries and ailments.

MEDIpont helped design the product, which is modeled on the lancets used for humans. Goldenrod™ draws four to 10 drops of blood from the mouse, while causing minimal discomfort. The process is similar to the “thumb sticks” diabetics use to test their blood sugar levels. Tests show that mice experience greater ease with Goldenrod™ than with alternative methods. In addition, it is safe, inexpensive, and easy to use. The lancet



comes with different point lengths for different size mice. The lancet allows the investigator to stick the mouse with enough pressure to ensure a good blood draw. The puncture is only as deep as the lancet point and leaves no scarring. Recovery time is almost immediate. ARS and MEDIpont have filed for patent protection on the lancet and a related dispenser, which can be used to obtain lancets rapidly in the lab. ARS researchers prepared and obtained the Institutional Animal Care and Use Committee approval for an animal bleeding protocol using the lancet at the ARS Plum Island Animal Disease Center in NY. MEDIpont has posted a generic protocol on their Website, which is now being used by Jackson Labs for routine mice bleeding.

Image courtesy Arnold Greenwell,
Environmental Health Perspectives

This technology won a regional Federal Laboratory Consortium award.



Protecting Valuable Crops. Researchers at the ARS Southeast Fruit and Tree Nut Research Laboratory in Byron, GA, discovered the existence of nickel deficiencies in agricultural crops. The discovery has led to the identification of symptoms for diagnosing nickel deficiencies in several major crops—like pecans, river birch, and day lilies. Nickel deficiencies in crops effect plant quality and yields, resulting in decreased profits for growers. ARS initiated a cooperative partnership to jointly develop a commercial nickel fertilizer product (Nickel Plus™), and a new company (NIPAN, LLC) was formed. NIPAN, the co-

owner of the patent, is negotiating an exclusive license to ARS’s interest in the technology for correcting

nickel deficiencies in plants. ARS researchers filed a patent application for using nickel fertilizer products. ARS helped develop nickel usage protocols and strategies for using the compound in crops. Previously, nickel was not of practical concern to farmers or gardeners, because it was believed that plants needed only minute amounts. In addition, nickel is abundant in most soils; therefore agricultural scientists, farmers, and gardeners have largely ignored using nickel.

To ensure the availability of nickel fertilizers, regulatory approval was obtained and nickel became the first nutrient element “officially” recognized by fertilizer regulators in 50 years. This provided the legal authority for approved sale and use of nickel fertilizer products within individual states. The new Nickel Plus™ technology is now being used in eight states, with other states likely to follow. The technology has cured mouse-ear and little-leaf disorders in pecan and river birch—saving these industries millions of dollars in losses. Evidence suggests that improving nickel nutrition may also help improve environmental quality by reducing fungicide and fertilizer use for certain crops. This opens a new frontier for using other nickel-related technologies.



Breeding New Plants for the Floral Industry. ARS researchers at the Floral and Nursery Plants Research Unit, part of the U.S. National Arboretum, developed a new floral crop, ‘Star-of-Bethlehem’ (*Ornithogalum*), for potted plant production. ARS researchers conceptualized the project and provided technical expertise to the plant industry.

In 1988, a Trust Fund Agreement between federal, industry, and university officials was established to fund the project. It was one of the first agreements to combine resources from several different industry partners to support both federal and university research. Material Transfer Agreements were used to test the cultivars throughout the world. In 1996, a Memorandum of Understanding (MOU) was established to test market the new crop. During this MOU, it was clear that plant protection was necessary for commercialization. As a result, ARS filed for patent protection—among the agency’s first plant patents.

ARS researchers developed five other new cultivars—‘Chesapeake Blaze’, ‘Chesapeake Starlight’, ‘Chesapeake Sunset’, ‘Chesapeake Snowflake’, and ‘Chesapeake Sunburst’—which have been patented and licensed to industry. These cultivars were selected as the October 2004 Blooming Plant of the Month—(*Ornithogalum*) by Super Floral Retailing New World Plants in California. Bay City Flower Company in California, Burbee & Sons in the Netherlands, and Stewart Plant in Australia, have received plant material and production technology.

Introducing new floral crops is critical for floral industry growth. However, the industry is composed of many small growers who cannot internally support new crop development. Small growers are responsible for producing minor floral crops, which in 2004 accounted for 25 percent of the wholesale value of all floral plants. In 2004, there were approximately 11,099 growers, 59 percent of which had sales less than \$100,000. Most new crops are produced by the smaller growers. This technology will result in an additional crop for them to produce, offers a new floral beauty for home use, and supports the continued growth of the floral industry.



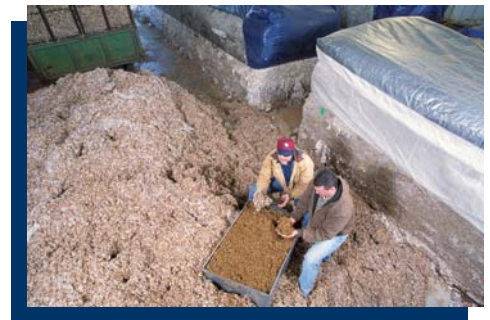
This technology won a regional Federal Laboratory Consortium award.



Turning Cotton Trash into Valuable Products. Cotton trash, also called byproducts (sticks, burs, staple lint and seed), produced from the cotton ginning process is often wasted due to the high expense associated with converting it into value-added products. ARS scientists developed the COBY (COtton BYproducts) process system that allows producers to turn cotton byproducts into livestock feed, fertilizer, fuel, and mulch, while reducing wear on processing machinery. The high cost of these processes is due in large part to the abrasiveness of the byproducts, which inflict extensive wear on processing machinery. Byproduct disposal can be costly,

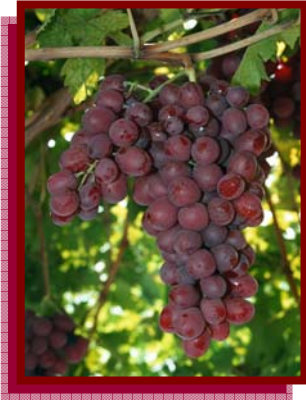
troublesome, and environmentally challenging—reducing producer profits. With COBY, byproducts from the gin, textile mill, oil mill, or other similar cotton/cottonseed processing facilities can be turned into a useful product—with little cost to producers. This method improves the marketability of cotton byproducts. Gin byproduct use can save the ginning industry an average of \$1.44 per bale of cotton in disposal costs, while generating revenue from what was once considered trash.

Products from the ARS-patented process were further developed under several cooperative studies. ARS researchers teamed with Texas Tech University researchers to determine the efficacy of using COBY products as a feed ingredient for livestock. In a second study, ARS worked with Texas Tech University and Morton Delinting, Inc., Morton, TX, to evaluate economic feasibility of using COBY products as fuel. In a final study with Summit Seed, Inc., Manteno, IL, the partners evaluated COBY products as a bedding and hydro-mulch for landscape applications. A pilot plant was built in Centre, AL, to evaluate and produce COBY material. As a result of studies at the pilot plant, a separate process was developed—an improvement over the COBY process for producing hydromulches—which resulted in a patent application being filed. The plant in Centre, AL just finished a run where they produced approximately 200 tons of this new "cotton-based mulch" (see Website: <http://www.cottonhydromulch.com>). This new process for producing cotton-based mulch is a cooperative effort between Summit Seed Inc., Cotton Inc., Mulch & Seed Innovations, and ARS. Insta-Pro, International, Inc., Des Moines, IA, holds exclusive licensing rights to the original COBY technology.



Giving U.S. Grape Growers a Competitive Advantage. The ARS grape breeding program in Fresno, CA just celebrated its 82nd anniversary. In the tradition of a strong research heritage, researchers at ARS's San Joaquin Valley Agricultural Sciences Center in Parlier, CA, developed several new varieties that have taken hold of the U.S. table grape industry and abroad. These new varieties were developed in cooperation with the California Table Grape Commission. The partnership was established to help give California grape growers a fair market advantage against growing pressure from international grape imports.

The team established a pilot program in which ARS licensed several of its new grape varieties to the Commission. The first U.S. grape variety to be licensed to the California Table Grape Commission was 'Sweet Scarlet,' a muscat-flavored grape. Muscat-flavored grape production for the fresh market is currently limited to one cultivar, Italia, a seeded grape. Italia's production has gone from 164,690 boxes in 1997 to 88,049 in 2000. 'Sweet Scarlet' is seedless, making it more desirable than the seeded Italia. 'Sweet Scarlet' also has very good firm flesh texture making it very desirable for the fresh market. It is



Scarlet Royal

likely that Sweet Scarlet production could be as high as 50,000 boxes per year (valued at approximately \$500,000). Over 131,000 plants were sold in the 2004 and 2005 nursery season.

This summer, ARS exclusively licensed two more grape varieties to the California Table Grape Commission—‘Scarlet Royal’ and ‘Autumn King.’ ‘Scarlet Royal’ is a red grape that has large seedless berries and good storage capability. The flesh is translucent and medium-firm. There is a gap in production of red mid-season seedless table grapes. ‘Scarlet Royal’ is a mid-season red seedless table grape that fills the gap between early and late red seedless

grapes, and it is more attractive than other grapes ripening at the same time. It is likely that ‘Scarlet Royal’ could replace 50 percent of red seedless grape production. In 2000, over 13.6 million boxes were produced during this time from the six most important red seedless grape varieties. At an approximate value of \$10 per box, the estimated value of Scarlet Royal in 10 years would be \$68 million.



Autumn King

‘Autumn King’ is a very late-ripening white seedless table grape that has very large berries. It will extend the season that white seedless grapes are available. ‘Autumn King’ produces large berries, without using gibberellic acid—commonly used to enhance fruit size. It is very desirable for the late-season white fresh table grape market. In 2000, over 1.38 million boxes (10kg/box) were produced after October 1 for other late season varieties. It is likely that production from ‘Autumn King’ will replace a majority of this within 10 years after its release.

The average American eats about seven to eight pounds of fresh grapes a year.

Updates on Previously Reported Downstream Outcomes



Developing Technology for Healthier Foods. Last year, ARS reported information on a technology we developed that helps prevent fresh-cut apples from browning. The calcium- and ascorbate (vitamin C)-based coating continues to ensconce itself into new commercial markets—helping Americans fight obesity problems by offering healthier food alternatives. ARS exclusively licensed the technology to Mantrose-Haeuser Co., Inc., Attleboro, Massachusetts. Apples coated with, NatureSeal® recently made a debut this fall in produce sections at Costco Wholesale stores. Fresh-cut apples using the ARS-developed technology now appear at McDonald’s restaurants and grocery stores, like Trader Joe’s. In addition, approximately 1000 schools across the nation are buying NatureSeal® to slice and treat apples for use in school lunches.