



September 2021

Agricultural Research Partnerships (ARP) Network NOTES

Welcome to ARP Network Quarterly Notes! Our goal is to keep you informed about ARP Network and Agricultural Research Service's current information. We hope that the notes build networking opportunities for businesses to connect with ARP Network Members.

Please help us spread the word by sharing ARP Network Notes with your company contacts, colleagues, other organizations, etc. Thank you!

ARP Network

The ARP Network enlists the help of partners to spark economic development, entrepreneurship and community development. USDA ARS founded the ARP Network to expand the impact of ARS research and provide resources to help companies grow. By combining ARS research expertise with complementary capabilities and talents of partnering organizations, the ARP Network helps stimulate economic growth through technological advancements. The ARP Network matches business needs with ARS innovations and research capabilities and provides business assistant services to help companies and startups solve agricultural problems, develop products and create new jobs. Learn more by visiting us on LinkedIn: <https://www.linkedin.com/in/agricultural-research-partnerships-arp-network-3863a8147>

ARS Office of Technology Website

Check out our website: <https://www.ars.usda.gov/ott>

Office of Technology Transfer

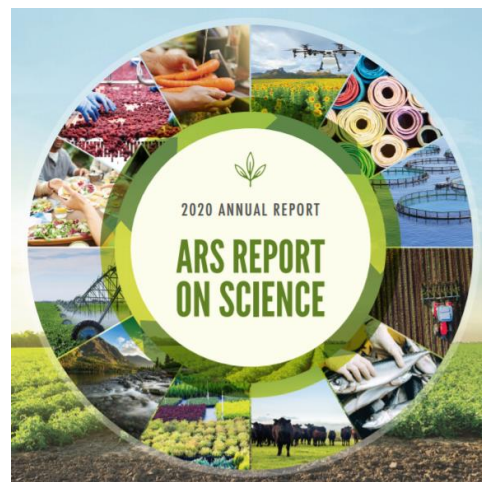
The Office of Technology

Transfer (OTT) helps move Agricultural Research Service (ARS) research discoveries to market to solve agricultural problems and expand the economic impact of ARS research and development.



2020 Annual Report on Science

The [ARS Annual Report on Science](#) is ARS Annual Report on Science is a compendium of ARS research accomplishments that demonstrates ARS's impact on the food we eat, the water we drink, and the air we breathe. Every year, ARS discovers real-world solutions to agricultural challenges affecting our nation and a growing world. The agency positions itself strategically to address these challenges by gathering input from customers and stakeholders and conducting research that addresses programmatic research goals throughout five-year cycles.



To learn more about ARS research programs, visit the [ARS Office of National Programs homepage](#).

USDA Annual Report on Technology Transfer, FY2020

The report highlights innovations from scientists and researchers that are solving problems for farmers, ranchers, foresters, and producers; and creating opportunities for American businesses to thrive.

USDA's FY 2020 [Technology Transfer Report](#) revealed USDA's total number of income-bearing licenses in Fiscal Year 2020 was 581, total number of active Cooperative Research and Development Agreements (CRADAs) was 221, total number of CRADAs entered by USDA was 84, and total number of new patent applications filed was 91. The report also contains new ag innovation and downstream outcomes.



ARS Scientific Discoveries Website

The [Scientific Discoveries website](#) highlights the national and international impact of ARS research on agriculture from the farmer's field to the consumer's table.

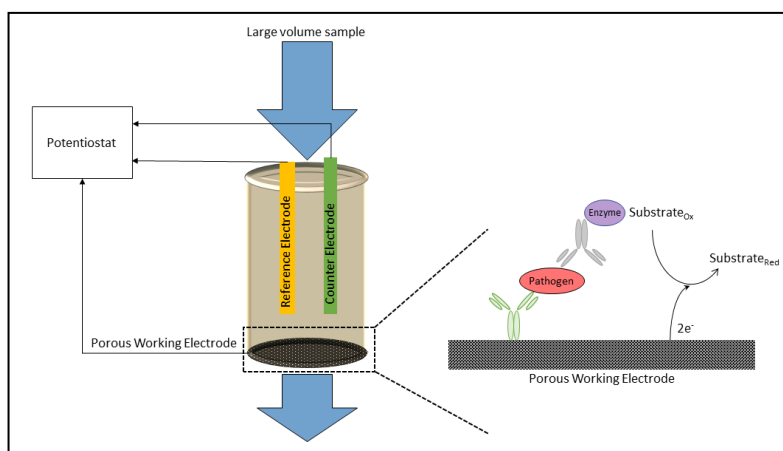


ARS Partnership and/or Licensing Opportunities

ARS is looking for industry partners interested in commercializing these technologies and/or evaluating them for potential commercial applications through a Cooperative Research and Development Agreement (CRADA). Many of these technologies are also available for licensing.

Flow-Through Immuno-electrochemical Sensor

A novel platform sensor for the selective detection of targeted microorganisms, nucleic acids, proteins, or chemicals in complex mixtures. Unlike most systems, this detection device is capable of handling large volume samples because of the porous nature of the capture surface. The device provides an unmet need for a rapid, portable, accurate sensor by addressing specific limitations associated with the current state of the art used by both industry and regulators.



Benefits

- Detection can be performed with sample volumes that are typically too large to be used with other molecular detection platforms
- Rapid: total assay time of ~4 hours
- Customizable: user defined oligonucleotides or antibodies can be applied
- Economical: can offer significant cost savings

Applications

- Detection and quantification of pathogens, spoilage organisms, toxins and/or biomarkers of interest
- Demonstrated applications using large volume liquid samples and ground meat homogenate

ARS Docket nos. 21.18 and 1.21. Please contact Jim Poulos: jim.poulos@usda.gov

Biosensor to Detect Isothiocyanates in Plants, Soils, and Seed Meals

Isothiocyanates (ITCs) are bioactive compounds of cruciferous plants that have anti-cancerous properties in humans and are commonly used to control plant pathogens in agriculture by cover cropping, seed meal amendment, or green manuring. Current methods to detect ITCs are time consuming and require specialized training. A novel biosensor detection method for ITCs can be used to analyze soils, plant extracts and solutions to determine the presence and relative level of a variety of different forms of ITCs. In agriculture, assessment of ITCs can inform the efficacy of cruciferous-based practices such as green manuring, validate safe replant dates, and identify cultivars with potentially high ITC production levels.



Benefits

- Simple easy-to-use method with short hands-on time for analysis
- Adaptable to on-farm use
- Amenable to a variety of media including soil, plant tissue, seed meal, and solutions
- Reduces risk of plant-back damage from Brassicas

Applications

- Determine safe plant-back dates after ITC soil biofumigation
- Assess cultivar potentials for ITC production levels
- Confirm ITC production in soil biofumigation, green manuring or cover-cropping

ARS Docket nos. 95.20. Please contact David Nicholson: david.nicholson@usda.gov

Aerial Electrostatic System for Weather Modification

A novel process for enhancing rainfall has been invented using only tap water. The water is electrically charged before it is released into warm continental or maritime convective clouds with an agricultural aircraft. This technique has been shown to double the amount of additional rainfall generated compared to conventional cloud seeding methods.



Benefits

- Doubles the additional rainfall generated by cloud seeding compared to conventional methods
- Uses only tap water instead of silver iodide or calcium chloride
- Operating costs are greatly reduced

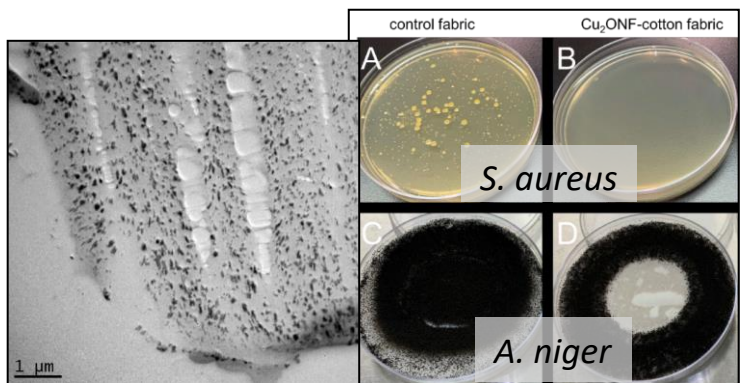
Applications

- Effective, cost efficient and environmentally friendly method of enhancing rainfall from warm continental or maritime convective clouds

ARS Docket No. 36.18 + 79.21. Please contact Cathy Cohn: cathleen.cohn@usda.gov

Process for broad-spectrum permanent antimicrobial cotton fibers

A synthetic procedure has been developed that imbues persistent antimicrobial activity against fungi in addition to Gram-positive and Gram-negative bacteria via copper oxide nanoparticles produced within cotton fibers. The manufacturing process can proceed at ambient temperatures without the use of chemical binding or reducing agents. The resulting nano-functionalized cotton fibers exhibit robust leach resistance during use and repeated laundering, and serve as a source for biocidal copper ions, regenerating the antimicrobial activity with each laundering.



Benefits

- Powerful: kills >99.995% of fungi and Gram-positive & Gram-negative bacteria
- Durable: maintains antimicrobial functionality even after 50 laundering cycles
- Pure: comprised of only cotton and copper oxide nanoparticles; no chemical additives
- Adaptable: cotton fibers can be blended in the fabrication of all woven or nonwoven textile products

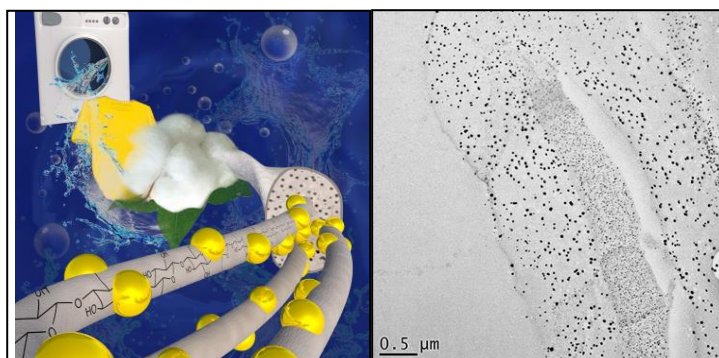
Applications

- Medical textiles (surgical masks and gowns, hospital curtains and bedding, etc.)
- Apparel (socks, underwear, athleticwear, military apparel, etc.)
- Home textiles (mattresses, blankets, etc.)
- Wound dressings and hygiene products
- Packaging for food and non-food items

ARS Docket No. 13.21. Please contact Tanaga Boozer: tanaga.boozer@usda.gov

Cotton Fibers Fighting Off Germs Wash After Wash

Novel, permanent antimicrobial cotton fibers are produced via in situ synthesis of silver nanoparticles inside the fiber. The silver nanoparticles encased within the fiber are leach-resistant against continuous launderings and serve as a reservoir for the release of biocidal silver ions, regenerating the antimicrobial surface wash after wash. This new nanotechnology tailored for cotton chemistry and structure is included in the invention.



Benefits

- Pure: consists of only cotton and silver nanoparticles; no chemical binders or coating matrices
- Powerful: kills 99.99% of both Gram-positive and Gram-negative bacteria
- Durable: retains the same antimicrobial function even after 50 laundering cycles
- Versatile: can be blended in the fabrication of all woven or nonwoven textile products

Applications

- Hospital textiles, socks, sportswear, military apparel, wound dressing, home textiles, hygiene products, and packaging

ARS Docket No. 18.19. Please contact Tanaga Boozer: tanaga.boozer@usda.gov

Bio-Based Adhesives

Composite wood panels (e.g., plywood, particle board, flake board, and hard board) are indispensable for the construction industry. A substantial cost of these panels is the adhesive required to bind the wood pieces together. Much interest exists to create inexpensive bio-based adhesives to replace the expensive synthetic adhesives. Adhesives and methods of generate bio-based adhesives to fabricate panels are presented in this invention.



Benefits

- Provides low-cost bio-resins and adhesives for numerous applications
 - Would result in eco-friendly composite wood panels for the building industry devoid of hazardous problems occurring when using synthetic resins
-

Applications

- Entirely organic and efficacious composite wood panels can be fabricated from relatively inexpensive agricultural by-products

ARS Docket No. 81.20. Please contact Renee Wagner: renee.wagner@usda.gov

Southern Cattle Tick Vaccine Product

The southern cattle tick is the most economically important external parasite and disease vector of livestock worldwide. Ticks resistant to chemicals used to treat cattle, or acaricides, are impossible to control. This anti-tick vaccine technology relates to novel fusion peptides and immunogenic compositions.



Benefits

- Anti-tick vaccine controls ticks, even those resistant to acaricides
- Vaccination of cattle against ticks is a safer technology to counter threat of tick-borne diseases

Applications

- Greener component of integrated southern cattle tick management
- Sustainable area-wide southern cattle tick control

ARS Docket No. 92.19. Please contact David Nicholson: david.nicholson@usda.gov

Composition and Method for Reducing Ammonia and Soluble Phosphorus in Runoff from Animal Manure

Calcium silicate nanoparticles are combined with manure amendments used to control ammonia emissions, such as alum, aluminum chloride, ferric chloride or sodium bisulfate. The mixture results in dramatically lower soluble phosphorus levels in manure, resulting in less phosphorus runoff and leaching.

Benefits

- This technology greatly reduces non-point source phosphorus pollution from animal manure

Applications

- The mixture of calcium silicate nanoparticles with acids used for ammonia control results in lower ammonia levels in chicken houses and less phosphorus runoff

Docket No: 32.20. Please contact Tanaga Boozer: tanaga.boozer@usda.gov

Immunogenic Composition to Prevent *Francisella* Infections in Fish

Increasingly, tilapia and other fish species have become the focus of healthy and sustainable farming methods. However, disease agents are a major threat to increased fish production. Piscine francisellosis, caused by *Francisella orientalis* (also known as *Francisella noatunensis* subsp. *orientalis* (Fo), *Francisella asiatica*), is a highly infectious disease that affects a wide range of fish species. There are currently no commercial vaccines to prevent francisellosis - and treatment options are extremely limited.

This invention is a recombinant vaccine that is effective at immunizing fish against *Francisella*-related infections. The vaccine is based on immunoproteomic approaches to identify immunodominant proteins in proteome of *Francisella orientalis* - from which a specific gene was found to stimulate a protective immune response (initially demonstrated in tilapia). In a trial testing the recombinant vaccine, immunized fish were shown to have a survival rate of over 80% after a 15-day exposure.

Benefits

- Could prevent economic losses in tilapia and other farmed fish species
- This vaccine does not have the risks associated with live-attenuated vaccines

Applications

- Prevent *Francisella*-related infections in fish

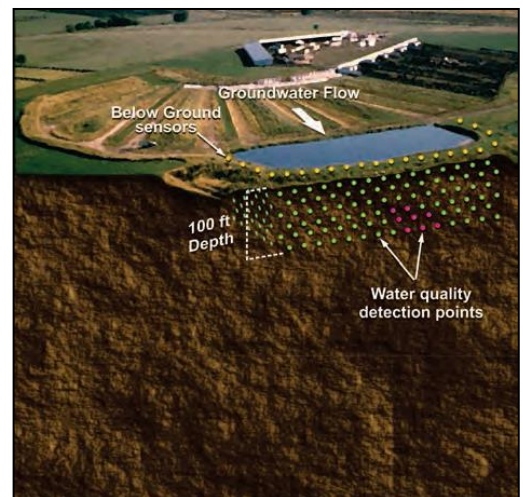
Docket No: 70.20. Please contact Tanaga Boozer: tanaga.boozer@usda.gov

Early Warning Wastewater Pond Monitoring System

A time-tested technology to function as an early-warning monitor for unintended discharge from wastewater holding ponds. Establishes a subsurface sensor curtain around the perimeter of a wastewater holding pond. When unintended discharge occurs, facility managers are notified so they can respond quickly.

Benefits

- Monitoring wells detect leakage after contaminants reach groundwater, typically long after discharge happens. Water quality samples are taken semi-annually to monitor for leakage. In contrast, the new system:
 - Provides continuous monitoring at many subsurface points traversing the perimeter of the pond.
 - Detects discharge before it reaches groundwater.



Below-ground sensor field (yellow dots) is placed around perimeter of pond.

- Can be wirelessly linked to the web for remote access.
- Can interface with other control and monitoring systems for expanded versatility.

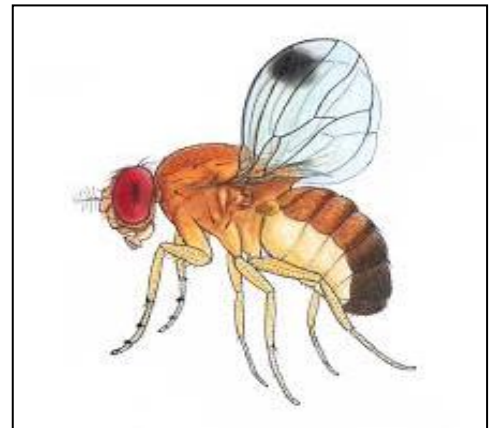
Applications

- Industries that temporarily store wastewater in earthen structures want better control of discharge to ensure sustainability and environmental quality
- Farm runoff holding ponds; oil and gas mining retention ponds; landfills; municipal ponds; and other industries

Contact: *Please contact Bryan Woodbury:* bryan.woodbury@usda.gov

Sweetly Control Fly Pests

Insect dipteran pests damage a wide range of agricultural crops and livestock and transmit a variety of vector-borne diseases to humans. Current control methods heavily depend on non-specific chemical insecticides which negatively impact the environment and human health and can lead to chemical resistance. There is a need to replace current control methods with environmentally friendly alternatives. ARS has developed an insecticidal formulation based on non-nutritive sugars to control spotted-wing drosophila adults, and it has potential to control other fly pests and mosquitoes.



Benefits

- The artificial sweetener formulation is a biologically-based insecticide
- Could be an organic control alternative to chemical insecticides
- Provides a safe and simple method

Applications

- The sugar formulation can be sprayed directly on berry crops including blueberry plants
- This formulation can be used as a delivery agent or feeding attractant combined with conventional or biological insecticides to enhance insecticidal efficacy
- The method can be expanded to other Dipteran pests

ARS Docket no. 47.19. *Please contact David Nicholson:* david.nicholson@usda.gov

RNAi Strategies for Control of Whitefly

A double stranded RNA that targets genes important for the viability of the whitefly. By suppressing expression of key genes, the whitefly dies quickly, reducing whitefly populations on plants treated with these RNA constructs or on modified plants producing the RNAs. Reduced incidence of whitefly numbers and whitefly feeding on plants has the potential to greatly reduce transmission of whitefly-transmitted plant viruses that infect a wide array of crops.



Benefits

- Provides broad plant protection against whitefly, *Bemisia tabaci*, *B. argentifolii*, and biotypes, by reducing populations
- Could result in a reduction in the use of insecticides in crop production
- Can be applied as topical product or incorporated into plant expressed systems

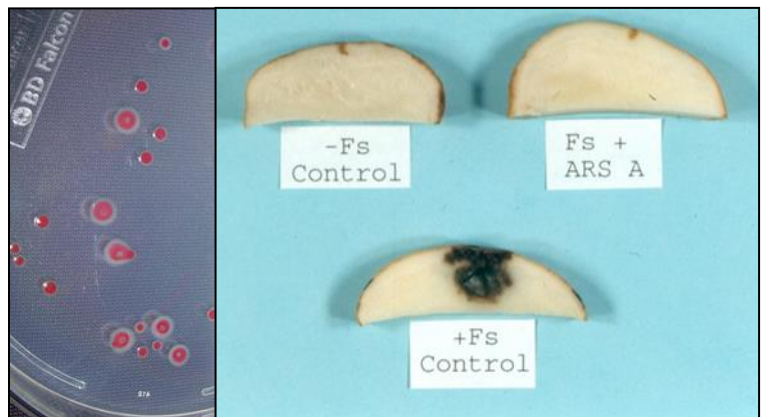
Applications

- Efficacious whitefly suppression to combat pest and the viral pathogens they transmit
- Increase yields by reducing losses to whitefly

ARS Docket No. 105.17 + 75.21. Please contact David Nicholson: david.nicholson@usda.gov

Desiccation Resistant *Pseudomonas*

Novel *Pseudomonas* strains were generated using adaptive laboratory mutagenesis to repetitively challenge the parent population during exposure to stressed conditions of growth, drying, long term dry storage and rehydration. Resistant variants were isolated and ranked based on high viable cell yield, recovery after dry storage, suppression of potato disease, and rapid growth on low cost medium, including hydrolyzates of renewable lignocellulosic biomass. The desiccation resistant bacterial strains and method of mutagenesis are included in the invention.



Benefits

- Is a dry storable agent that provides broad protection against a variety of potato maladies, including fungal diseases (Fusarium dry rot, late blight, pink rot, and others) and sprouting
- Will reduce the use of azole chemistries in agriculture that have lost efficacy due to widespread resistance of target pathogens
- May lessen efficacy loss of medically important azoles used to control fungal infections in humans

Applications

- Is a biological agent to be applied to potatoes (and potentially other crops) to control fungal infections and reduce sprouting

ARS Docket No. 137.17. Please contact Renee Wagner: renee.wagner@usda.gov

Antisense Oligo Targets Bacterial Pathogens in Plants and Insects

This invention relates to bactericidal molecules to suppress bacterial pathogens inside of plants (Citrus trees or Potato) and insects (Hemiptera: Psyllids and Leafhoppers).

Specifically, *Liberibacter* pathogens, but also gram-negative or gram-positive bacteria. Suppression of *Liberibacter* bacteria in

potatoes reduced symptoms, and suppression of bacteria in citrus trees is associated with increased retention of fruits.



Untreated infected

Treated infected

Benefits

- Provides protection against Bacteria, including *Candidatus Liberibacter (Citrus pathogen)* and *Candidatus Liberibacter solanacearum* (potato pathogen)

Applications

- Prevent and reduce spread of citrus huanglongbing, HLB and Zebra Chip in potato
- Suppression of other bacterial plant pathogens
- Suppression of insects by targeting endosymbionts

ARS Docket No. 40.17. Please contact Tanaga Boozer: tanaga.boozer@usda.gov

Protein Nanoparticles for Hydrophilic Coating

A group of nanoparticles that change the wetting property of various types of materials. When a solution containing these nanoparticles is sprayed on the surface of objects that do not get wet with water, the surface of the target material is coated with nanoparticles and changes its wetting properties instantly. Subsequent spray of water mist forms a thin film instead of forming droplets on the surface of object material. Therefore, if the object material is a transparent one such as glass pane, its visibility is much better than the one without nanoparticle treatment. The ARS research is looking for an industry partner to continue developing the technology.



Benefits

- When the nanoparticles are used as a coating material for transparent materials such as glass and transparent plastics, the surface wetting characteristics are modified without affecting the transparency
- When the aqueous suspension of the developed nanoparticle is sprayed on the surface of target material, the nanoparticle adsorbs in a matter of seconds

Applications

- As a surface treatment to alter wetting properties of a variety of materials such as glass panels and acrylic sheets
- Could be used for improving visibility of windshields, mirrors and goggles
- This surface-modifying property can also be used on stainless steel, porcelain and polymer films made of non-transparent plastics

YouTube Videos:

- https://www.youtube.com/watch?v=OsHi151zo_A&t=0s
- <https://www.youtube.com/watch?v=BHNQXdP4ffU>

Docket No: 41.21 + 131.11. Please contact Renee Wagner: renee.wagner@usda.gov

Berry Catcher System

A berry catcher that has an elastic catcher sheet sandwiched between upper and lower hollow rims. A protector sheet is stretched across the lower rim. The system is structured so that as a harvester moves across a field, falling berries are caught by the catcher sheet as the protector sheet simultaneously protects the underside of the catcher sheet.

Benefits

- System is designed to reduce berry bruising in machine-harvested fruit
- The system could be incorporated into existing commercial over-the-row harvesters and platform-based harvest-aid systems

Applications

- Machine-harvesting berries such as blueberries, raspberries and blackberries destined for fresh-market packaging

ARS Docket nos. 50.15. Please contact Jim Poulos: jim.poulos@usda.gov

An Economical X-ray Based Irradiator with High Dose Uniformity and Precision

A cabinet style irradiator employing standard commercially available x-ray components in a novel configuration that allows for precise dosimetry in real-time along with unprecedented uniformity of radiation dose among samples.



Benefits

- Substitute for gamma irradiation using radioisotope-based sources and subsequent reduction in cost, regulations, and safety concerns for operators
- High dose precision and uniformity
- High reliability and proven ruggedness

Applications

- Insect sterilization for Sterile Insect Control technique
- Irradiation of small samples such as seeds, nuts, grain, sprouts or rice

ARS Docket nos. 38.20. Please contact David Nicholson: david.nicholson@usda.gov

Available Technologies for Licensing

Each year, approximately 60 new patents are issued by the U.S. Patent Office for USDA inventions. The Office of Technology Transfer (OTT) transfers these inventions through licenses to the private sector for commercialization. Click [here](#) for a link to *recently filed* U.S. patent applications that are available for licensing.

Snapshot of ARS Technology Transfer

A brief information sheet that highlights some ARS Technology Transfer metrics and commercial products resulting from ARS Research. Click [here](#) to read.

Resources for Businesses

Some resources for small businesses at USDA and other Federal agencies. Click [here](#) to read.

Tellus

Tellus is a digital experience that features stories about the cutting-edge work at ARS. **Tellus**, Latin for Earth, reflects the global reach of our efforts to feed a growing population while remaining good stewards of the land. Click [here](#) for the latest articles.



An ARS-developed peanut skin extract helps to fortify milk chocolate without affecting flavor or texture. (Photo by Peggv Greb,

ARS Latest News

USDA's ARS is a leading source for U.S. agricultural research. The ARS vision is to lead America towards a better future through agricultural research and information. Click [here](#) for the latest news.

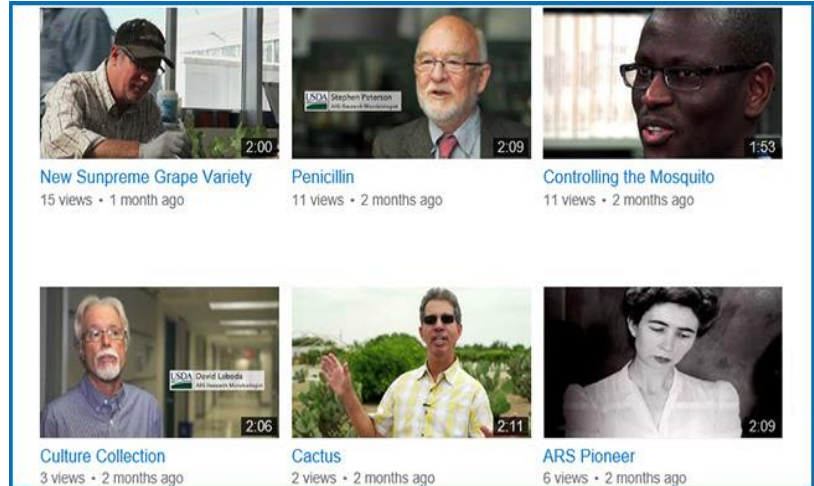
ARS Podcasts

Learn about innovations and research that ARS scientists are conducting:

<https://www.ars.usda.gov/oc/podcasts>

USDA-ARS YouTube Channel

Did you know that ARS is on YouTube? Explore our new YouTube channel to see how our research touches your life: [USDA-ARS YouTube Channel](#)



ARS

The Agricultural Research Service (ARS) is USDA's primary internal research agency. ARS conducts research to develop and transfer solutions to agricultural problems that are both national and international in scope. ARS has nearly 2,000 scientists nationwide and a few in overseas locations. ARS scientists carry out 690 research projects on a variety of subjects. ARS has a Congressional mandate to disseminate the research findings of these projects to the American public and other interested parties. Learn more by visiting: <http://www.ars.usda.gov>

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