



June 2017

## 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 statewide with your company contacts, colleagues, other organizations, etc. Thank you!***

### 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 750 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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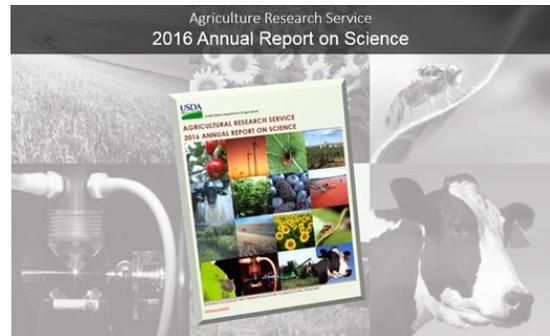
### ARP Network

The ARP Network enlists the help of partners to spark economic development, entrepreneurship and community development. USDA ARS founded the ARP Network in an effort 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: <https://www.ars.usda.gov/business/Docs.htm?docid=24715>.

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## ARS 2016 Annual Report on Science

Agricultural Research Service's 2016 annual report on science has been published. It is composed of numerical research outputs for the agency, accomplishments and impacts for each goal in the ARS 2012-2017 Strategic Plan, and ARS' performance plan for 2017.



The report can be found at:

<https://www.ars.usda.gov/ARSUserFiles/00000000/NPS/OAA/2016%20ARS%20Annual%20Report.pdf>.

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## New ARS Historic YouTube Videos

ARS is pleased to debut a video series highlighting important scientific advances that occurred because of ARS research. The first [YouTube video](#) highlights ARS' role in large-scale commercial production of penicillin. While discovered in England, the ability to mass-produce penicillin occurred in the United States at an ARS lab in Peoria, Illinois. The second [YouTube video](#) highlights two agricultural discoveries that literally changed the world, Dextran and xanthan gum.

These videos showcase two of the many advances made by ARS that touch American lives daily. Please visit the USDA YouTube channel (<https://www.youtube.com/usda>) in the future for more videos in this series.

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## 2017 Agricultural OUTLOOK Interview

Dr. Chavonda Jacobs-Young, ARS Administrator, and Mojdeh Bahar, ARS Assistant Administrator for Technology Transfer, were interviewed for the 2017 edition of Agricultural OUTLOOK, an annual publication that offers a comprehensive overview of food, agriculture, natural resources, and related issues. Read the interview on [nxtbook.com](http://nxtbook.com).



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## ARS Partnership and/or Licensing Opportunities

### Extraction of Phosphorus and Proteins from Manure

A novel method for extraction and recovering amino acids and phosphorus from animal and municipal wastes and other biological materials such as algae or crops has been developed. From raw manure, wet solids are dissolved in acidic solution and then treated with a basic solution so phosphorus will precipitate and be reclaimed. The proteins can be extracted and concentrated with ultrafiltration and flocculation. Separated proteins can be processed into Amino Acids after acid hydrolysis. This could be a potential new revenue stream from wastes.

#### Benefits

- Recovery of phosphorus will lessen environmental impact of manure storage and treatment
- Recovered protein has wide range of commercial applications
- Potential new revenue stream from wastes

#### Applications

- Recovery systems can be used in both animal and municipal waste collection systems to create a new revenue stream

ARS docket no. 80.15. Please contact Joe Lipovsky: [joe.lipovsky@ars.usda.gov](mailto:joe.lipovsky@ars.usda.gov).

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### Double Stranded RNA Constructs for Aphid Control

Detailed are novel double stranded RNA constructs that target either Chloride Intracellular Channel (CLIC) or Sucrase gene expression in Aphids. The use of these constructs have shown increased mortality in aphid species, including but not limited to *Diuraph*

#### Benefits

- Reduce the use of noxious chemical pesticides
- Broad application, effective against a range of aphid species
- Not harmful to beneficial insect species.
- Increased crop yields

#### Applications

- The dsRNA construct can be used in conjunction with traditional baits in traps, applied topically to crops via a solution, or delivered to the target aphid population via a plant mediated delivery in a transgenic plant resistant to range of aphid species

ARS docket no. 177.12 (U.S. patent no. 9,580,709) and 41.17. Please contact Jeff Walenta:

[jeffrey.walenta@ars.usda.gov](mailto:jeffrey.walenta@ars.usda.gov).

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### Use of Phyllosphere Associated Lactic Acid Bacteria as Biocontrol Agents to Reduce Bacterial Growth on Fresh Produce

The use of phyllosphere-associated lactic acid bacteria that demonstrate inhibitory effects on the growth and maintenance of human pathogens, such as *Salmonella enterica*, on the surface of food products, particularly fresh fruits and vegetables.

#### Benefits

- Bacteria are applied in liquid or freeze dried powder forms onto food surfaces or agricultural environments that are already contaminated with pathogenic bacteria
- Treatment of produce can take place either pre- or post-harvest

- Easily implemented, low cost solution

#### *Applications*

- Could be used to eliminate prevalent food-borne pathogens
- Bacteria could also be used to decontaminate food processing environments and machinery as part of a normal sanitization process

ARS Docket no. 76.14. Please contact Jeff Walenta: [jeffrey.walenta@ars.usda.gov](mailto:jeffrey.walenta@ars.usda.gov).

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### **Tissue Specific Regulatory Elements Derived from Citrus**

As more genetically altered plants are developed in response to diseases and the need to increase yield for food products, a need exists for transcription and translation regulatory elements capable of directing strong transgene expression in specific tissue cells and translating mRNA into a protein or peptide or RNA of interest. ARS scientists have developed expression vectors that are useful for tissue specific transcription of a heterologous polynucleotide and translation of a peptide or protein of interest. The regulatory elements are active in root cells, phloem cells, or fruit/abscission zone cells.

#### *Benefits*

- Localized expression of genes of interest
- The regulatory elements are derived from citrus and have been tested in different genetically altered plant species
- These regulatory elements are active in dicots

#### *Applications*

- Expression vectors containing regulatory sequences that direct transgene expression in specific tissue and translation of a peptide or protein of interest

ARS Docket No. 135.14. Please contact David Nicholson: [david.nicholson@ars.usda.gov](mailto:david.nicholson@ars.usda.gov).

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### **Adhesive Compositions and Methods of Adhering Articles Together**

There is ongoing interest in using agro-based materials (like proteins) in wood adhesives. The issues are cost, adhesive strength, and water resistance. New adhesive compositions involving cottonseed protein are shown here to be attractive adhesive ingredients. These include the use of specific modifiers that enhance cottonseed protein performance and several biopolymers (soy protein or polysaccharides) that can decrease the cost of use. With these compositions, the performance/cost ratio for cottonseed protein-based adhesives can be enhanced. These can be used as eco-friendly and cost-effective products for wood adhesives.

#### *Benefits*

- Use of agro-based materials will minimize toxicity and environmental impact
- Cottonseed protein with modifier provides effective adhesive strength and water resistance
- Blends with cheap biopolymers can decrease cost
- Potential new products for wood adhesives

#### *Applications*

- Adhesive compositions can be used as cost-effective, eco-friendly, and sustainable ingredients in wood adhesives

ARS docket no. 115.16. Please contact Joe Lipovsky: [joe.lipovsky@ars.usda.gov](mailto:joe.lipovsky@ars.usda.gov).

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### **Attractant Compositions for Weevils of the Genus *Otiorhynchus***

A major problem in combating *Otiorhynchus* weevil attack is monitoring and timing control measures. Because of the night-activity of the adult weevils, growers do not observe the emerging weevils in time to treat with pesticides before the insects begin to lay eggs. Selective attractants would allow monitoring of weevils before the onset of egg-laying. ARS has developed a formulation of attractants consisting of plant volatiles and a weevil trap design effective for attracting weevils.

#### *Benefits*

- Monitoring of weevils could help growers identify sites that are at risk for infestation. These nocturnal insects could be trapped, then identified and treated during daylight hours
- For pest management, lure and kill could provide a solution
- Early control of the weevils could reduce the amount of pesticides used

#### *Applications*

- The chemicals described may be used alone or in combination to attract different species of *Otiorhynchus* weevils. Any of these chemicals used with the trap design are effective for luring the weevils away from nursery stock and preventing oviposition to control weevil populations

ARS Docket no. 23.17. Please contact David Nicholson: [david.nicholson@ars.usda.gov](mailto:david.nicholson@ars.usda.gov).

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### ***Pseudomonas* Species for Weed Suppression and Annual Grass Weed Management**

*Pseudomonas fluorescens* strain ACK55 is a naturally occurring soil bacterium that selectively inhibits the root development of cheatgrass, medusahead, and jointed goatgrass. This biologically based herbicide reduces these annual grass weeds, over time, in cropland, turf, rangeland, and roadsides. Methods are provided for the isolation and use of weed-suppressive *P. fluorescens*. ARS is pursuing regulatory approval for use of strain ACK55.

#### *Benefits*

- These bacteria are a cost-effective and long-term control method alternative to herbicides.
- Use can lead to reduction in wildfires, as well as, improved cropland yields and rangeland forage potential

#### *Applications*

- The bacteria can be used to coat seeds or added directly to soil. These strains provide species specific control of invasive grasses and do not cause major change to the soil microbial community.

ARS Docket no. 36.17. Please contact David Nicholson: [david.nicholson@ars.usda.gov](mailto:david.nicholson@ars.usda.gov).

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### **In Vitro Parasite Feeding System**

The apparatus is an in vitro system for gathering parasites such as ticks for research, the production of vaccines, and the production of other products related to diseases spread by parasites. The system includes a feeding vessel having an inlet, an outlet, and a membrane positioned across an opening in the vessel. Parasites (preferably ticks) are allowed to attach themselves to the membrane so that as a feeding fluid (preferably blood) is circulated through the vessel, the parasites feed on the feeding fluid through the membrane.

#### *Benefits*

- A simple, flexible, and economical tick feeding system that closely simulates a tick's preferred host throughout the entire tick life cycle
- Standardized, quality controlled vaccine production

### *Applications*

- Full tick life cycle system for production of live pathogen stage specific vaccines or testing of anti-tick compounds

ARS Docket no. 116.15. Please contact David Nicholson: [david.nicholson@ars.usda.gov](mailto:david.nicholson@ars.usda.gov).

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### **Cryogenic Trap**

A thermoelectric cryogenic trap system and method used to separate and identify inorganic and organic arsenicals in a vapor stream. Arsenic is a naturally occurring element in the Earth's crust. It is present in many foods due to absorption from soil and water. Rice in particular can take up more arsenic than other foods and, being a highly consumed food item, can contribute significantly to arsenic exposure. Long-term exposure to arsenic from drinking-water and food can cause cancer and skin lesions. It has also been associated with developmental effects, heart disease, diabetes, and damage to the nervous system and brain. To protect consumers from excessive exposure, the Codex Alimentarius Commission recommends that no more than 0.35 mg/kg of inorganic arsenic should be allowed in husked rice (paddy rice from which the husk only has been removed, also known as brown rice or cargo rice.) But not all arsenic species are toxic and because there are vast differences in toxicity among arsenic species, speciation is crucial. The ARS cryogenic trap can accurately measure highly toxic inorganic arsenic species present in food at a lower cost compared to the currently used HPCL-ICP MS system.

### *Benefits*

- The cryogenic trap is cost effective, sensitive and selective
- No reagents or coolants (i.e. no liquid nitrogen) used. It is a physical approach

### *Applications*

- Monitoring to protect consumers from dietary arsenic exposure
- To uphold regulations and protect consumers, methods capable of inorganic arsenic detection at ng g<sup>-1</sup> level are needed. Because rice is such an important crop, it was selected as the model matrix in this work
- Monitoring of environmental pollution
- Pharmacokinetic, clinical and toxicology studies

ARS Docket No. 118.15. Please contact Jim Poulos: [jim.poulos@ars.usda.gov](mailto:jim.poulos@ars.usda.gov).

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## **ARS Partnership Opportunities**

### **Improved Extender Medium for Preservation of Honeybee Spermatozoa**

This technology, Fargo Honeybee Extender Medium, is an aqueous formulation for the preservation of honeybee spermatozoa. As compared to existing cryopreservation media, initial use of the Fargo Honeybee Extender Medium has shown a profound increase in the survival of spermatozoa cryopreserved long term. Even more remarkable, the Fargo Honeybee Extender Medium has also shown significant survival of Honeybee spermatozoa stored at room temperature for over a year. Therefore, this this new medium may significantly improve protocols requiring long-term storage of honeybee spermatozoa and artificial insemination of a honeybee queens. Improved spermatozoa storage and artificial insemination of honeybees could increase the efficiency of breeding honeybees and assist with honeybee population issues.

ARS Docket No. 90.17. Please contact Jeff Walenta: [jeffrey.walenta@ars.usda.gov](mailto:jeffrey.walenta@ars.usda.gov).

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### **Soil Microbial Inoculant to Increase Crop Water-Use Efficiency**

This technology is a novel microbial strain that when applied as a soil inoculant can increase plant water-use efficiency by up to approximately thirty percent (30%). This soil inoculant has been tested with two plant species, Arabidopsis and Corn. However, it is likely to be applicable for a wide range of crops. The commercial potential could be relevant to any agricultural system where crop water-use-efficiency may be limiting production. ARS Docket No. 134.16. Please contact Jeff Walenta: [jeffrey.walenta@ars.usda.gov](mailto:jeffrey.walenta@ars.usda.gov).

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### **Nut Butter Stabilizer**

Tree nuts, groundnuts (peanuts) and oilseeds (such as sunflower kernels) that are used to make "nut butters" have up to 60% oil content. When ground into nut butters, some of the oil is stabilized by adhering to the ground solid particles, but some percentage of the oil remains unbound and will separate out and form two layers. Manufacturers of stabilized nut butters frequently use fully hydrogenated vegetable oils, sometimes combined with monoglycerides, to prevent the liquid oil from separating. However, the FDA has removed the GRAS status for hydrogenated oils, and some consumers have a negative perception of hydrogenated oils. Therefore, ARS has developed the use of inexpensive natural ingredients, which are already used in many existing food products, to stabilize the nut butter and prevent separation of oil from nut solids. ARS docket no. 96.15. Please contact Renee Wagner: [renee.wagner@ars.usda.gov](mailto:renee.wagner@ars.usda.gov).

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### **Biobased Resins/Adhesives for Wood Composites**

There has been significant interest in utilization of non-petroleum based adhesives and resins to fabricate wood composites, particularly for interior uses. Unfortunately, currently available bio-based adhesives derived from soybean meals are more expensive than their petroleum counterparts. ARS has developed methodologies to employ inexpensive by-products from corn ethanol processing for production of a more cost-effective biobased adhesive/resin for this purpose. ARS docket no. 166.16. Please contact Renee Wagner: [renee.wagner@ars.usda.gov](mailto:renee.wagner@ars.usda.gov).

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### **Reusable Pathogen Detection Apparatus**

Scientists at the USDA ARS and Wildlife Services in collaboration with Iowa State University have developed a reusable, noninvasive, dynamic sampling platform with low volatile organic compound (VOC) background capable of collecting VOSs emitted by multiple growing bacterial cultures simultaneously using solid-phase microextraction (SPME). This technology offers significant advances in the detection of pathogenic bacteria such as *Mycobacterium bovis* by shortening detection times from the traditional culture methods that can take up to 3 - 6 weeks to as little as 1 week. Most importantly, the system is closed, significantly reducing the risk of accidental exposure to the pathogen or contamination of the VOC sample. This reusable apparatus offers a significant cost savings to traditional culture methodologies, is broadly applicable to other sampling substrates (e.g., blood, serum, urine, tissue culture), and represents a new product line for the public and environmental health industry. Developers of this technology would be interested in discussing partnership opportunities with private entities. Please contact John Eisemann [john.d.eisemann@aphis.usda.gov](mailto:john.d.eisemann@aphis.usda.gov).

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## 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. Here is a link to *recently filed* U.S. patent applications that are available for licensing. This list is updated monthly so check back often! <http://www.ars.usda.gov/Business/Business.htm>.

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## ARS Digital Online Research Magazine

*AgResearch* is a monthly publication highlighting short features on the scientific research discoveries occurring at all of ARS' research laboratories across the Nation and abroad. View *AgResearch* at <http://agresearchmag.ars.usda.gov>. One can subscribe to electronic delivery of the magazine on the website.



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## USDA Blog

Check out USDA Blog site for updates on Agricultural issues: <http://blogs.usda.gov>. One can sign up for email updates on the website by checking boxes of categories of interest including the blog, news categories and social media.

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*We are seeking contributions for future ARP Network Notes from members who wish to share information that would be of interest to the group. Suggestions include events, Ag challenges and community initiatives. For ideas of content for future notes, please contact Cathy Cohn at [cathleen.cohn@ars.usda.gov](mailto:cathleen.cohn@ars.usda.gov).*

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Get more information: [www.ars.usda.gov](http://www.ars.usda.gov)

