



# Ag Innovation News

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# 2013

## AURI announces research initiatives

Sixteen projects will create new and improved uses for Minnesota's agriculture commodities

BY AMANDA WANKE

AURI recently announced 16 research initiatives for 2013. The projects in the organization's core four focus areas—renewable energy, biobased products, coproducts and food—all aim to create new and improved products and processes in Minnesota's agriculture industry in order to grow the economy and create new jobs.

"Agriculture is critical to the strength of Minnesota's economy. It is the second

largest employer in the state. Ensuring a stable, growing agriculture industry means a stronger economic future for Minnesota," says AURI Executive Director Teresa Spaeth. "All of these research projects aim to create economic growth and jobs for the state by bringing to market new products and improved processes."

AURI will partner with commodity groups, economic development organizations, foundations and others across the state to ensure that the information available

through these research initiatives is put in the hands of the businesses, entrepreneurs and producers who will bring these ideas to commercialization.

"As we evaluate our potential initiatives, we know that they fit a number of criteria including that the information is important to the industry, that the projects are technically and commercially near term, and that there is a promising partnership or team to do the work," explains Jen Wagner-Lahr, AURI senior director of innovation

and commercialization. "Most importantly we evaluate whether businesses and entrepreneurs will be interested in the information. If they are, then there is reason to move forward based on that interest in moving it into the market, translating to jobs and wealth creation."

The following is a brief summary of the projects, with more information available at [auri.org](http://auri.org).

PHOTOS BY ROLF HAGBERG



### Biobased Products



#### Opportunities for Biobased Coatings

AURI will compile and distribute an assessment of the opportunities available in the area of biobased coatings.

#### Higher Value Uses for Ag Fibers

Ag fibers, such as corn stover, wheat straw, and native prairie grass, are currently put back into the soil as nutrients, used in biomass, or in other low-value ways. This project will look at possible ways to create higher value uses.

#### Soy-Based Polyol Research

This initiative will examine the feasibility of producing soy-based polyols, which are similar to fatty acids but more flexible, from soybean oil. This initiative will identify the products and economic challenges and opportunities of converting soybean oil to polyols in biodiesel plants when biodiesel production is not profitable.

#### Biobased Industry Needs Assessment

AURI will identify and create a contact database of key biobased products, service providers and companies to assist with the development of this industry.



### Food



#### Food Safety Interventions

AURI will provide a series of food safety workshops and conduct panel discussions with industry experts to demonstrate interventions processors can make to ensure their products meet industry standards.

#### Sensory Evaluation Laboratory

A new sensory lab will support AURI's mission of researching, developing and implementing new uses or value improvements for Minnesota agricultural commodities and food products. This lab will be a collaboration with Southwest Minnesota State University.

#### Food Coop Peer-to-Peer Forums

This forum will bring together food co-ops to share information and resources to increase their likelihood of success.

#### Food Hub Resource Assessment

This project will identify the existing capacity of a regional, grassroots-based food distribution system in Minnesota through a self-assessment to identify regional resources and assist linking producers and consumers.

#### Clean Label Alternatives Report

AURI will identify alternative ingredients to current additives, chemicals and processing agents in order to address consumers desire for all-natural ingredients but still provide the food safety and performance functions as previous ingredients.



### Coproducts



#### Coproducts Assessment

This project will determine potential value-added opportunities for coproducts (secondary products developed from a core product or process) that are undervalued or underutilized.

#### Identifying Lower Cost Grain Processing Coproducts for Swine Diets

The objective of this study is to determine the ideal ratio of condensed distiller's solubles (CDS) to wet distillers' grains (WDG) when feeding pigs via a liquid feeding system from wean to finish with a focus on lowering costs for swine producers.

#### Health Benefits of Biomass Heat in Turkey Barns

This research will determine the air quality, bird health, litter quality and overall environmental conditions of turkey barns that use a biomass heating system in comparison to barns that use conventional propane-fired systems that are not vented.



### Renewable Energy



#### Ethanol Plant Zero Liquid Discharge

This project would compile a list of technologies and retrofitting costs to help ethanol plants have zero liquid discharge from their processes.

#### Biofuels in Minnesota

AURI will continue to support Minnesota's biofuels industries by participating on various taskforces, councils, and advisory groups, as well as offering lab services, to assist with further development in this industry.

#### Biomethane from Producer Gas Assessment

Producer gas from anaerobic digesters and other renewable sources is often insufficiently pure to be used as a renewable fuel; AURI will review the available clean-up technology and identify resources that could address these limitations.

#### Biodiesel Troubleshooting

By helping to troubleshoot cold-weather handling issues with biodiesel, AURI will help ensure a strong future for Minnesota's biodiesel industry.



# Unlocking Wild rice's health benefits

Health-conscious consumers drive  
demand for new products

BY JONATHAN EISENTHAL

Wild rice, the high-protein, high-energy cereal grain long revered by native peoples as a sacred and life-giving food, may be a significant source of beneficial compounds that could grow the commodity's consumer base. In particular, early indications of the cholesterol lowering effect of wild rice, its potential as a staple in diabetic or insulin resistant-diets and its use as a natural food preservative all offer potential means for adding value to this important grain product.

"We believe the nutraceutical or functional food potential of wild rice offers new opportunities for consumers, producers and processors," says Beth Nelson, president of the Minnesota Cultivated Wild Rice Council.

To explore the research done thus far on wild rice's nutritional benefits and therefore identify future possible research and projects that may lead to commercialization, AURI commissioned a literature review, which was spearheaded by AURI Project Manager Randy Hilliard.

University of Minnesota Food and Science Nutrition Professor Daniel Gallaher conducted the scientific literature review of wild rice in partnership with Professor Mirko Bunzel, chairman of the Department of Food Chemistry and Phytochemistry at Karlsruhe Institute of Technology in Germany.

Bunzel's specialty in phytochemicals proved to be a key element in the research. Phytochemicals are a class of compounds that, while not considered vitamins, may have considerable health benefits. Among many found in wild rice, they found particular promise in a phytochemical called oryzanol.

"Oryzanol is a compound present in other cereals, but which seems to be present in

greater concentrations in rice," says Gallaher. "There is evidence that it produces a cholesterol-lowering effect."

The report cites University of Minnesota research, funded by the Minnesota Cultivated Wild Rice Council, in which rats' cholesterol production dropped to zero when wild rice was added to their diet. The response was not as dramatic in humans, but Gallaher says the work points to a way to unlock the health potential of the grain.

"Oryzanol is bound in the wild rice in such a way that it may not be very available for absorption in the human gastrointestinal tract," Gallaher says. "So one idea we have is to process the wild rice in a way to release the oryzanol, so it would have this biological effect."

Wheat bran has been successfully processed this way, so research would be needed to determine if it can be done economically with wild rice as well.

Wild rice has also won a small but devoted following as a flavoring ingredient in brats and hamburgers, and this has led to further research and the discovery that wild rice possesses anti-oxidant properties that, when mixed with meat, keep the product fresher for a longer time period.

"With food producers that want to maintain a natural food ingredient list and stay away from artificial preservatives, wild rice could be a very interesting additive," says Gallaher. "It does add its own distinct flavor, so it might not work with every product—consumer research would have to work out which products make a good match."

In addition, scientists want to measure the glycemic index of Minnesota wild rice, says Gallaher: "We need to have the glycemic index for Minnesota wild rice measured, and then it can be publicized as a food that works well in diets geared to diabetes or insulin resistance—the pre-diabetic condition."

"We have seen exciting indications in this review, and believe that these findings could lead to further research and commercialization, spurring interest in developing new products to take to market," says Hilliard. "We look forward to future opportunities to partner with the Minnesota Cultivated Wild Rice Council and others to bring some of these ideas to the market."

AURI will also take the information in the literature review, which can be viewed online at [auri.org](http://auri.org), and bring it to the attention of food processing companies and engineers, to spur the further development of this important Minnesota commodity. ■

PHOTO BY ROLF HAGBERG

# STILL IN OUR SIGHTS



**AURI and Partners**

**Idea to reality:**

In order to support Minnesota's corn and soybean industries, there is a need to constantly generate ideas for new products and processes using those commodities.

**AURI's role:**

In 2009, AURI worked to identify and select the best potential new uses for corn and soybeans.

**Outcomes:**

Staff is constantly revisiting that information and sharing it with Minnesota's producers and processors in order to help bring these ideas to commercialization.

**Partners:**

Minnesota Soybean Research & Promotion Council and Minnesota Corn Research & Promotion Council.

BY LIZ MORRISON

A little more than three years ago, AURI teamed up with the Minnesota Corn Research & Promotion Council and the Minnesota Soybean Research & Promotion Council to vet some 200 emerging technologies and identify those with the greatest potential to add value to corn and soybeans. The goal was to give Minnesota

farmers and agricultural processors a glimpse of coming opportunities.

So how clear was AURI's crystal ball?

Since late 2009, some promising technologies have stalled, others have steadily advanced, and a couple of underdogs have jumped to the forefront.

"We've had big crops, and lots of raw materials available," which encourages the search for new uses, says Doug Root, AURI senior scientist of biomass & renewable products technologies. However, "Crop prices are up, too," while natural gas prices have fallen by half. That has changed the financial picture for many promising corn

## Top Opportunities for Corn

- Improved corn ethanol processing
- Second-generation biofuels
- Green chemicals



## O P P O R T U N I T I E S

### Efficient ethanol production



Several alternative ethanol technologies are in the research or pilot-plant stage of development, says AURI's Senior Director for Innovation & Commercialization Jen Wagner-Lahr. Private companies and land grant universities are working on conversion of corn stover to biofuel utilizing advanced enzyme technologies, improved yeast, and other promising avenues.

Meanwhile, "Standard corn ethanol fermentation continues to improve every year," Root adds. For example, modern ethanol plants now produce the biofuel with little or no water discharge, boosting efficiency and lowering water usage. There have also been big improvements in improving fuel yield and ethanol's energy ratio — the amount of energy it takes to make ethanol compared to the amount of energy supplied by ethanol.

### Front-end corn fractionation



Separating corn kernels into their components — hull, germ and starch — before fermentation holds great promise for improving ethanol plant profits. But the technology is still at the pilot-plant scale. In addition, front-end fractionation will require large capital investments and will greatly increase the complexity of ethanol plant operations, which is likely to delay implementation.

On a related front, AURI is working with researchers at the University of Minnesota to demonstrate new, cheaper techniques to extract zein, a valuable protein, from fractionated corn.

### Biobutanol



Butanol, a high-value industrial alcohol currently worth about \$10 per gallon, is usually made from petroleum. But new technology uses corn starch fermentation to produce renewable biobutanol, much like ethanol is made. Luverne, Minn., biofuel producer Gevo recently completed the world's first commercial-scale renewable biobutanol plant, investing \$40 million. Highwater Ethanol in Lamberton, Minn., is also installing biobutanol technology, giving the plant the flexibility to produce either ethanol or biobutanol, depending on markets.

### Biobased chemicals



Renewable, plant-based chemicals are beginning to replace petrochemicals in many consumer goods, and Minnesota companies are in the forefront of innovation.

For example, NatureWorks, based in Minnetonka, is a leading producer of PLA, a plastic made from corn. The company's Ingeo™ biopolymers are showing up in more and more products, such as clothing, bottles, cards, films, textiles, food packaging and more. AURI is working with several Minnesota companies that are manufacturing building materials with corn-based biopolymers.

Another state leader, BioAmber in Plymouth, has commercialized a proprietary process for making bio-succinic acid, an important chemical used to make solvents, plastics, personal care products, resins, and many other consumer goods. BioAmber is now producing bio-succinic acid in one of the world's largest plant-based chemical manufacturing facilities, located in Pomacle, France. NatureWorks and BioAmber last year formed a joint venture, AmberWorks, to commercialize new plant-based polymers.

# A progress report on advances in corn and soybean opportunities

and soybean processing ideas, he says, discouraging some and favoring others.

Corn stillage digestion is one opportunity that has moved to the back burner for the time being. Ethanol plants can use anaerobic digestion to generate methane, a natural gas substitute, from their own distillation byproducts, reducing the need

for fossil fuel. But interest in the capital-intensive technology has waned as natural gas prices plunged.

By contrast, fractionation of corn distillers grains — a technology that didn't even make the A-list three years ago — has been adopted by nearly all Minnesota ethanol plants. The market drivers: revived

biodiesel manufacturing, which topped a billion gallons in 2012, and soaring soybean oil prices. These trends have boosted demand for non-food-grade corn oil to make renewable diesel and other bioproducts, Root says. Using the new techniques commercialized by innovative companies like GreenShift and PrimaFuel,

ethanol plants across the corn belt are now extracting corn oil from distillers grains.

These two examples show the dynamic environment for agricultural innovation, Root says. Most of the top opportunities identified three years ago “have moved forward to some degree,” says Michael Sparby, AURI senior project strategist, “and AURI has been part of many of them.” And even though development has been slower than expected in some sectors, Root adds, AURI’s 2009 snapshot is still “a pretty good peek around the corner at what’s coming in the future.”

Below is a brief update on where some of those “top opps” are today. ■

Read more about AURI’s “top opps” for corn and soybeans at:

[auri.org/2009/08/informa-corn-report/](http://auri.org/2009/08/informa-corn-report/)

[auri.org/2009/08/informa-soybean-report/](http://auri.org/2009/08/informa-soybean-report/)



## O P P O R T U N I T I E S

### Improved biodiesel production



After falling by half in 2010, when federal tax credits lapsed, U.S. biodiesel production recovered in 2012, topping one billion gallons. Minnesota’s two large-scale biodiesel facilities, REG in Albert Lea and Minnesota Soybean Processors in Brewster, are producing biodiesel at full capacity.

New biodiesel manufacturing methods, including enzymatic transesterification and hydroprocessing, are still in the research phase, Root says, and implementation will be a big challenge. “There’s a real need for partnerships between scientists and engineers, businesses, and organizations like AURI that can help with implementation.”

### Green chemicals



Record soybean oil prices have weighed on the development of new soybean-based products, such as bioplastics and renewable resins, Root says. “The need for new uses is less urgent than three years ago because of higher prices.” However, basic research on new technology is continuing in both private and public organizations.

### New uses for glycerin



As biodiesel volume rebounded, supplies of glycerin, a biodiesel coproduct, have climbed. At the same time, demand for glycerin, especially refined glycerin, has strengthened; the product is used in soaps, lotions and many other consumer products. That has buoyed refined glycerin prices and prompted biodiesel plants across the country to install glycerin purification technology to capture the extra value.

Crude glycerin is also in demand for livestock feed, especially for cattle and hogs, says Al Doering, AURI coproducts scientist. AURI has done a lot of work on the use of glycerin in livestock feed, sponsoring research aimed at helping growers incorporate more of this economical feedstuff.

### Specialty soybeans



Public and private plant breeders are developing soybean varieties that have special traits for specific end uses. Two new examples on the horizon: Higholeic oil soybeans and low oligosaccharide soybean meal. Higholeic oil soybeans produce an oil that stays fresh without hydrogenation and holds up under high-heat deep frying. Low oligosaccharide soybeans present an opportunity for improved feed efficiency with soybean meal containing less oligosaccharides and more protein.

### Specialty livestock feeds



Global demand for soy protein concentrate for livestock feed is surging, Root says, in part because supplies of fish meal, an alternative protein source, are declining due to overfishing. AURI is doing a great deal of work on cost-effective methods of processing soybeans for specialized nursery pig and aquaculture diets, Sparby says. These processing improvements, now being commercialized by Minnesota companies, are opening up new markets in North America and Asia.

# Klean & green

BY LIZ MORRISON

In the early days of radio, “Klean Soap” was a fictitious product that helped advertisers understand how to use the new medium.

Now, there’s a real Klean Soap.

Last January, with help from AURI, a group of Twin Cities entrepreneurs launched a line of “green” cleaners made from recycled vegetable oil and glycerin.

The Klean Soap product line includes liquid degreaser, carpet shampoo, chewing gum remover, stain remover, and a heavy-duty mechanics’ hand cleanser that contains corn cob grit. Glass cleaner and everyday hand soap are in the works.

“We’re taking waste oil and recycling it two times over — first to make biodiesel fuel and then to make soap,” says Cassandra Rodrigue, one of the partners in the start-up company, Klean, LLC. Other partners include Cassandra’s parents, Tom and Julie Rodrigue, her sister Tamara Rodrigue, and businessmen Dipak Patel and Jerry Seehusen.

## Soap by accident

The soap venture grew out of the Rodrigue family’s main business, Cedar Towing & Auction, Inc., in Minneapolis. A few years ago, Tom Rodrigue, an idea man and do-it-yourself kind of guy, got interested in making biodiesel to fuel his company’s tow trucks. He collected used vegetable oil from restaurants at the Minneapolis-St. Paul airport and started experimenting.

His first attempt at making biodiesel in a 45-gallon reactor flopped. “I produced a bunch of glop!” Cleaning out the equipment afterwards, he noticed that “my hands were very clean and very soft.” He’d made soap by accident!

Tom persisted with the biodiesel enterprise, launching Cedar Biofuels in 2009. The business converts about 3,000 gallons of used cooking oil a month into renewable biodiesel, which Cedar Towing uses in its fleet, reducing the company’s fossil fuel consumption.

One of the byproducts of biodiesel manufacturing is glycerin, a common ingredient in soap. Thinking back to his original batch of accidental soap, and its remarkable degreasing powers, Tom wondered if he could produce not only fuel, but also a really good cleaner.

That question led the Rodrigues to Doug Root, a senior scientist at AURI’s Marshall analytical chemistry lab. Earlier, Root had advised Tom on small-scale biodiesel production.

Root says that, “Producing quality biodiesel fuel is challenging for small-scale producers and ‘off-spec’ fuel or glop must be kept out of the commercial markets. I was glad to help the Rodrigues find a business opportunity from an initial failure to produce acceptable biodiesel for their towing business.”

Klean Soap turning recycled cooking oil into green cleaners



Pictured at the Minneapolis-St. Paul Airport, which is testing Klean Soap products, are (left to right): Dipak Patel, John Mercier of HMS Host, Tom Rodrigue, Butch Howard of HMS Host, Cassandra Rodrigue, and Tami Rodrigue.

PHOTOS BY ROLF HAGBERG



Klean Soap, being used above by business partner Tom Rodrigue and AURI scientist Doug Root, is made from recycled vegetable oil and glycerin. The product line includes liquid degreaser, carpet shampoo, chewing gum remover, stain remover, and a heavy-duty mechanics' hand cleaner.

He now helped the family purify the crude glycerin coming from their biodiesel plant, and perfect their product recipes and manufacturing process. "This would never have gotten off the ground without Doug's help," Tom says.

The first hurdle was producing consistent soap products from a wide variety of used fats and oils with different characteristics and impurities. "What you put in is what you get out," says partner Dipak Patel. "Our input is variable, so our biggest challenge is standardization."

Another challenge was product color. "We started out thinking we needed to change the color," Cassandra says. The liquid soaps "looked like root beer," crude glycerin's natural color. Root helped the group explore several bleaching options, but each had disadvantages, so "they decided to market the cleaners with the natural color of the components," Root says. Sticking with the natural color also fits their green product branding, Cassandra adds.

Scent was also a problem, Patel says. The original cleaners gave off a whiff of French fries! The group experimented with different fragrances, finally settling on a lemon scent for the degreaser and carpet cleaner and a fresh linen scent for the hand cleanser.

## Testing at the airport

Klean Soap products are now being tested at the Minneapolis-St. Paul Airport by ABM, which provides facility maintenance and janitorial services. There's a lot of grease cleanup to be done from the fryers in airport restaurants, says Tom Hunter, ABM airport operating manager. Chewing gum stuck to the carpet is another problem. "Tom Rodrigue asked us to try their Klean Soap products, and they performed really well," Hunter says.

The degreaser and carpet cleaners "are highly concentrated, so it takes less product to do the job, and they don't leave a lot of residue like some cleaning products." On tile, the degreaser "seems to get the grout cleaner than other products." It's also effective on hard surface floors, rubber mats, and frying equipment.

Another advantage: the environmentally friendly cleaners don't need any special treatment before disposal, Hunter says, so cleaning water can be flushed down the drain.

"It's one of the best soaps we've used," says Denise Fauke, ABM account manager. "And it's a nice story," she adds — one that fits in well with the Metropolitan Airport Commission's strong focus on recycling.

## Targeting commercial cleaners

Klean Soap is now working on sales and distribution plans. The soap market "is an extremely competitive industry," Patel says. But the little start-up has two important advantages, Root notes: "Access to low-cost fats and oils, and customers who want to try their products."

Klean Soap hopes to enter the expanding retail market for green household cleaners, which rang up sales of \$640 million in 2011 — up from about \$300 million in 2007, according to Packaged Facts, a market research firm.

To start, though, the company is targeting janitorial services and commercial facilities, such as restaurants. Patel and Seehusen operate a property management company that contracts cleaning services, giving Klean Soap a link to that market, too.

Getting the new venture off the ground has been tough, says Tamara Rodrigue, but "We all believe in this." Cassandra adds: "Klean Soap works so well, and we love the meaning behind it." ■



**AURI and  
Klean Soap™**

### Idea to reality:

A Minnesota family company wanted to use recycled vegetable oil and glycerin from their small biodiesel plant to make green cleaning products. They needed help with glycerin purification and product formulation and testing.

### AURI's role:

AURI scientists helped purify the crude glycerin and perfect the product recipes and manufacturing process for Klean Soap.



### Outcomes:

Klean Soap now makes five all-natural cleaning products, which are being tested at the Minneapolis-St. Paul Airport. The company is also seeking green certification and setting up a distribution network.

# Rural Innovation Network

## Q&A with AURI Rural Innovation Network Director Nan Larson

PHOTOS BY ROLF HAGBERG



Nan Larson, Rural Innovation Network Director

BY AMANDA WANKE

### What is the Rural Innovation Network?

AURI is all about adding value to agriculture through research in proven but innovative ways. Our innovation strategy is 1) generate

ideas for value-added agriculture, 2) select the best ideas that have the potential to create the greatest return for our existing ag industry, and 3) implement those ideas in the marketplace to grow our economy. The Rural Innovation Network focuses on collaboration with other organizations, such as commodity organizations and economic development organizations, to determine the highest impact projects and research. Once that research is done, we disseminate that information to the businesses and entrepreneurs who are looking for ways to take those ideas to commercialization. We try to start conversations about our research that will lead to action. Our 2013 initiatives, found on page 2, are great examples of the types of research and projects we're doing.

### How does the Rural Innovation Network work?

We bring together different networks such as commodity groups, economic development organizations, initiative foundations, industry partners, and others, in large and small groups, around specific topics in AURI's core four areas: food, renewable



Jen Wagner-Lahr, Senior Director of Innovation & Commercialization

energy, coproducts and biobased products. We build connectedness in those groups of people to help identify the highest impact research needs and then bring together the right people to implement the ideas in the marketplace. In my role I maintain different networks and bring additional people into the process.

### Why is the Rural Innovation Network important to AURI?

Commercialization success requires many participants from private business, as well as service providers and economics developers, financiers, and often government and academia. We strive to bring the necessary mix of individuals to the table to benefit the businesses that are interested in moving forward with innovations. Building these bridges are essential to innovation success.

### What do you mean by implementation?

Research is just the beginning of what AURI does, not the end. Research reports or studies don't do any good just sitting on a shelf. We want to find an existing business or new business that is interested in pursuing commercialization, so that the information we've researched becomes a reality in terms of a marketable process or product.

### What's an example of what happens through the Rural Innovation Network?

For example, a community may have a business that has waste products (known as coproducts) that they'd like to sell or find other some way to make that waste create value for their business. AURI can partner with the community or local economic development organization and the business to help determine a feasible, cost-effective way, through research or our hands-on scientific assistance, to create value from those waste products, making the business more profitable and therefore growing the economy in that community. Again, bringing the right people together around the right opportunity.

### Does someone "join" the Rural Innovation Network?

Individuals and organizations with an interest in value-added agriculture and innovation in our core four areas of food, renewable energy, coproducts and biobased products are invited to participate in events specific to each area, receive news about our research in those areas, and network with others with an interest in these areas. Simply email [news@auri.org](mailto:news@auri.org), and we'll subscribe you to our newsletter and events announcements. ■





# Possible food supplement from ethanol production?

BY RANAЕ JORGENSON, AURI ANALYTICAL CHEMIST

Could corn used for fuel, also be used for food? Hans van Leeuwen thinks so.

Coproducts left over during ethanol production are currently used to add nutrition to livestock diets, and now researchers are looking at ways to create a nutritious supplement for humans from this process. In a recent project I had the honor to work with Hans van Leeuwen, Ph.D., an Iowa State University professor, as part of his research team that is looking at creating a new food supplement with products leftover from processing corn into ethanol. His product, called MycoMeal, contains valued amino acids found in meat and could help provide an affordable, highly nutritious supplement to those suffering from malnutrition.

MycoMeal is a product created by cultivating edible fungus (there are other edible fungi in the world including mushrooms, porcini and truffles) on thin stillage from corn-to-ethanol plants. The process of growing the fungus also cleans water from ethanol production so that it can be recycled back into fuel production. This water reclamation process earned the research team the Global Award for Applied Research in the 2012 International Water Association

Global Project Innovation Awards. The International Water Association (IWA) established the Project Innovation Awards to recognize excellence and innovation in water engineering projects throughout the world. Only six global awards are given every two years, and before competing on the international level, projects go through a rigorous preliminary round through affiliated organizations worldwide.

While the research is primarily being conducted at Iowa State, here at AURI's analytical chemistry lab in Marshall, Minn. I analyzed MycoMeal's nutrient composition for components such as protein, fat, minerals and fatty acids. The opportunities presented through this process are important to Minnesota ethanol plants because they present ways to make ethanol production more economical.

Here's a quick overview of how the process works:

For every gallon of ethanol produced, there are about five gallons of leftovers known as stillage. The stillage contains solids and other organic material. Most of the solids are removed by centrifugation and dried into distillers dried grains that are sold as livestock feed, primarily for cattle.

The remaining liquid, known as thin stillage, still contains some solids, a variety of organic compounds and enzymes. Because the compounds and solids can interfere with ethanol

production, only about 50 percent of thin stillage can be recycled back into ethanol production. The rest is evaporated and blended with distillers dried grains to produce distillers dried grains with solubles.

The researchers add fungus to the thin stillage and it feeds and grows into a thick mass in less than a day. The fungus removes about 60 percent of the organic material and most of the solids, allowing the water and enzymes in the thin stillage to be recycled back into production.

The fungus is then harvested and dried as animal feed that's rich in protein, certain essential amino acids and other nutrients. It can also be blended with distillers dried grains to boost its value as a livestock feed and make it more suitable for feeding hogs and chickens.

Van Leeuwen says the production technology can save United States ethanol producers up to \$800 million a year in energy costs. He also said the technology can produce ethanol coproducts worth another \$800 million or more per year, depending on how it is used and marketed. ■

## Strengthening ag research in Minnesota

### Internationally acclaimed research institute Battelle is conducting study



BY AMANDA WANKE

AURI works across Minnesota agriculture to identify the highest-opportunity research needs that will lead to new products and processes using agriculture commodities. Then, staff partner with research organizations to conduct and implement that research in the marketplace. In order to align research needs with the research organizations best prepared to address them, AURI recently partnered with the internationally acclaimed research institute Battelle to conduct a Minnesota Ag Research Capacity Assessment.

As a result of this assessment, Minnesota will benefit through:

- In-depth knowledge of the resources, strengths and capabilities of Minnesota's various research organizations and how their capabilities compare with the rest of the nation
- Integration of highly qualified research teams with high-value ag commercialization program opportunities
- Improved utilization of Minnesota's research organizations' resources for the greatest impact
- Ability to attract significantly more grant funding to the state of Minnesota from national commodity organizations, federal research organizations, foundations and other granting organizations

*A special thanks to the Minnesota Soybean Research & Promotion Council and Minnesota Corn Research & Promotion Council for their funding support of Phase II of the AURI-Battelle Minnesota Ag Research Capacity Assessment.*

"The purpose of this study is to identify Minnesota research organizations' strengths and capacities. Then we can match these capabilities with identified needs and opportunities based on input from ag commodity groups and agribusiness leaders. This approach brings together the best research teams to work on the industry's top commercialization opportunities," explains AURI Senior Director of Science & Technology Rod Larkins, who is leading the capacity assessment.

"AURI is committed to helping businesses, entrepreneurs and producers turn their ideas into reality. Research needs to be brought to the marketplace and implemented in order to have economic impact," explains Larkins. "This project, along with AURI's commitment to implementation, will help ensure Minnesota has the most effective agriculture research possible."

The capacity assessment, expected to be completed in spring 2013, is being coordinated by AURI and led by a steering team of representatives from across the state, including Agriculture Commissioner Dave Frederickson; Office of Higher Education Commissioner Larry Pogemiller; and representatives from Minnesota Turkey/Chicken and Egg Association of Minnesota, Glenmore Consulting, Fredrickson-Byron, Minnesota Corn Research & Promotion Council, University of Minnesota, MnSCU, Soybean Research & Promotion Council, Farmers Union Industries, USDA Agricultural Research Service and First Green Partners. ■

Rod Larkins, AURI Senior Director of Science & Technology





# Making progress by identifying needs

BY TERESA SPAETH  
AURI EXECUTIVE DIRECTOR

At AURI we're all about making progress in agriculture by identifying opportunities to use Minnesota's commodities in new products and processes, which will strengthen agriculture, create jobs and grow the economy.

Sometimes progress emanates from new ideas and other times it emanates from a need. For example, there's a need for expanded renewable energy and a need to find nutritious, lower cost feed for livestock. These are needs that Minnesota producers, researchers and processors are positioned to meet through innovation. In order to spur innovation that is based not on a whim but on fact, AURI is helping agricultural organizations and businesses identify needs with an unbiased, research-based methodology.

So, what is a need? When working through a needs assessment process, the definition of a need is "the gap between what is and what should be." It's important to note that this definition of a need doesn't mean being needy, which can have a negative connotation. Instead, this definition of a need establishes a call to action. We're not assessing deficits, but identifying the gap between what is today and what could be tomorrow. It is in this gap that opportunities are identified and innovation happens.

At the same time that AURI is working to help identify needs that we may be able to help meet, we're also doing asset assessments so that we can pair together the needs that are identified with the organizations that have

the capacities to help meet that need by creating a new product or process. The AURI-Battelle Minnesota Ag Research Capacity Assessment that you read about on page 9 is an identification of Minnesota's research assets to clearly define the strengths and capabilities of Minnesota's various research organizations.

When we work together across agriculture to identify the highest impact needs, and match those needs with the businesses, entrepreneurs and research organizations best positioned to meet those needs, we will end up with innovation and growth in our economy. By meeting needs we are creating a stronger future. ■

## ELSEWHERE IN AG INNOVATIONS

BY ASHLEY HARGUTH  
CARTOONS BY UNCLE HYGGLY

*Editor's note: As a service to our readers, we provide news about the work of others in ag utilization. Often, research done elsewhere complements AURI's work.*

### Eco-based fire logs

Grass clippings from mowing lawns often end up in landfills but the ARS is working on mixing these clippings with other natural compounds to create eco-friendly fire logs that burn evenly and brightly. These eco-logs contain no petroleum-based chemicals, unlike many burning products, which mean they burn cleaner. The logs can be made up of anywhere from 20 to 60 percent clippings and the rest is known as binders or plant-derived waxes or oils. These logs can also be made from corn cobs or other agricultural-harvest leftovers and the formula of the logs can be used to produce pellets for a stove.

USDA-ARS  
Nov/Dec 2012



### Color changing potatoes

Carotenoids are great for eye health and the USDA is working to create more food options that contain carotenoids. Through breeding cultivated white potatoes with wild potatoes that have a rich yellow flesh they have created potatoes with carotenoid levels more than 15 times the level of the popular Yukon Gold potato.

Science Daily  
October 24, 2012



### Extreme soy

Paintball, a popular pastime, is a billion-dollar industry that has started to make their products more environmentally friendly. Some companies have started replacing the polyethylene glycol with U.S. soy oil in the paintballs. By making this change, the balls are safer to use around wildlife and water, lowering the sport's environmental impact.

United Soybean  
October 20, 2012

### Rolling along on soy

Tractors are full of soy; from biodiesel fuel to soy-plastic body panels. Now tractors are driving on soy-based tires. Bridgestone recently announced it is testing a tire for tractors that contains 10 percent soybean oil. The tires could hit the market early next year and each 900 pound tire contains about 90 pounds of oil from about eight bushels of soybeans.

United Soybean  
October 20, 2012

### Creating safer spinach

Scientists at the University of Illinois are combining continuous ultrasound treatment with chlorine washing to boost current industry standards by reducing the total number of E. coli bacteria by over 99 percent on spinach leaves. The scientists have used the technique on iceberg and romaine lettuce as well as spinach with similar results.

University of Illinois College of Agricultural, Consumer and Environmental Science  
November 27, 2012



### Nike's green shoe

Nike recently released a new soccer shoe, made from Pearlthane ECO's thermoplastic polyurethanes. According to a spokesperson this shoe provides an alternative to 100-percent petroleum-based materials without compromising performance properties. In addition, the new shoes are 15 percent lighter than traditional shoes.

Waste and Recycling News  
October 31, 2012

### The Wheat Genome Map

Scientists at the USDA Agricultural Research Service are part of an international team that have completed wheat genome sequencing. This sequencing could speed up the development of new wheat varieties, which in turn is expected to increase wheat yields and create enhanced nutritional value. USDA scientists have also completed similar studies on dairy cattle, tomatoes, corn and soybeans.

USDA ARS  
November 28, 2012

## AURI'S CORE FOUR QUIZ

How much do you know about AURI's core four areas: food, renewable energy, coproducts, and biobased products? Take the below quiz.

### Food Products

Which reason below is NOT one of the reasons salt is added to processed meat products?

- a. Flavor
- b. Color
- c. Preservation
- d. Creates Bind

Answer: b

### Renewable Energy

What is the term for biological material such as wood, crop residue and other solid wastes that could be used to produce energy?

- a. Biomass
- b. Leftovers
- c. Biostuffs

Answer: a

### Coproducts

What is a briquette?

- a. Leftovers from a French sandwich
- b. A brick of biomass
- c. Machine used to burn pellets

Answer: b

### Biobased Products

What biobased product can be used to preserve wood utility poles, instead of the petroleum that is frequently used?

- a. Biodiesel
- b. Ethanol
- c. Froglube
- d. Propaniedol

Answer: a

## ABOUT AURI

The Agricultural Utilization Research Institute (AURI) helps develop new uses for agricultural products through science and technology, partnering with businesses and entrepreneurs to bring ideas to reality. AURI staff are skilled to walk clients through the entire development journey of bringing a new product or process from idea to reality.

## Service Areas: What We Provide

### Applied Research and Development

Through practical, applied research we identify emerging opportunities to add value to agriculture products. This information is publicly available in order to help entrepreneurs and businesses generate ideas for new products and processes.

### Innovation Networks

When deciding the feasibility of a new product or process, it is critical to have access to industry experts and a science-based network of people. With a broad range of networks, AURI can help bring together the right people at the right time.

### Hands-on Scientific Assistance

Scientists are available to provide consulting and technical services in the areas of:

- Product and process development
- Product evaluation and testing
- Sourcing materials, equipment and services

Labs are available to clients for hands-on testing and development.

### Learn More

- Contact one of the AURI Offices to speak with a project development director about your business.
- Visit [auri.org](http://auri.org) to see the latest research and learn about upcoming events.
- Sign up to receive the Ag Innovations newspaper or the AURI electronic newsletter to stay informed about AURI projects and clients.
- Follow AURI on Facebook and Twitter to get notices about new research, upcoming events, where to find AURI at tradeshows and much more.

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PHOTO BY ROLF HAGBERG

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# TURKEY-TASTIC

AURI helps turkey producers reach a growing audience

BY AMANDA WANKE

Consumers who are looking for low-fat, high-protein options for their diets are increasingly turning to turkey as a tasty alternative. AURI scientists have assisted the Minnesota Turkey Growers Association with the development and nutritional analysis for several delicious turkey food options. Read more about two of these projects.

## Turkey Sandwich Wins State Fair Award **YUM**

When Turkey To Go and AURI teamed up to create the Giant Juicy Turkey Sandwich, they knew they had a winning formulation. This year, they proved that assertion by earning the inaugural Minnesota State Fair People's Choice "Best Food or Beverage" award as voted upon by fairgoers.

AURI Meat Scientist Carissa Nath and Senior Scientist of

Cereal and Nutrition Charan Wadhawan worked with the Minnesota Turkey Growers on more than a dozen recipe attempts before the right seasoning mixture was developed. Because of turkey's mild flavor, it easily takes on the taste of whatever ingredients are added.

"It was fun and challenging, which is one of the exciting things about research and development," Nath says. "It's rewarding when you can help a client get a product they are happy with."

Steve Olson, executive director of the Minnesota Turkey Growers Association, which owns the Turkey To Go brand, says the sandwich has helped them realize a 25 percent increase in turkey consumption at the fair. Serving sandwiches and drumsticks consumes more than 3,100 Minnesota-grown birds during the 12-day run.

## Recipes Give Consumers Healthy Turkey Options

Are you looking for some new menu options? Each year at their Minnesota State Fair booth, the Minnesota Turkey Growers Association offers new turkey recipes to visitors. Those recipes are sent to AURI's Food Scientist Charan Wadhawan for nutritional analysis. Check out some great-tasting options including Slow Cooker Fajita Wraps, Roast Turkey Panini, and Italian Turkey meatballs, at [minnesotaturkey.com/statefair/](http://minnesotaturkey.com/statefair/).

Turkey To Go is also available at various locations in the Twin Cities including two food carts in downtown Minneapolis as well as Target Field. ■



## AURI and Minnesota Turkey Growers Association

### Idea to reality:

The Minnesota Turkey Growers wanted to create a flavorful turkey sandwich that would be popular with consumers, as well as identify the nutrition facts for various turkey recipes.

### AURI's role:

AURI scientists provided product development and nutritional analysis services.

### Outcomes:

Turkey To Go, owned by the Minnesota Turkey Growers, won the "Best Food or Beverage" award at the Minnesota State Fair; they also have many recipes available at the state fair and on their website.



PHOTOS BY ROLF HAGBERG