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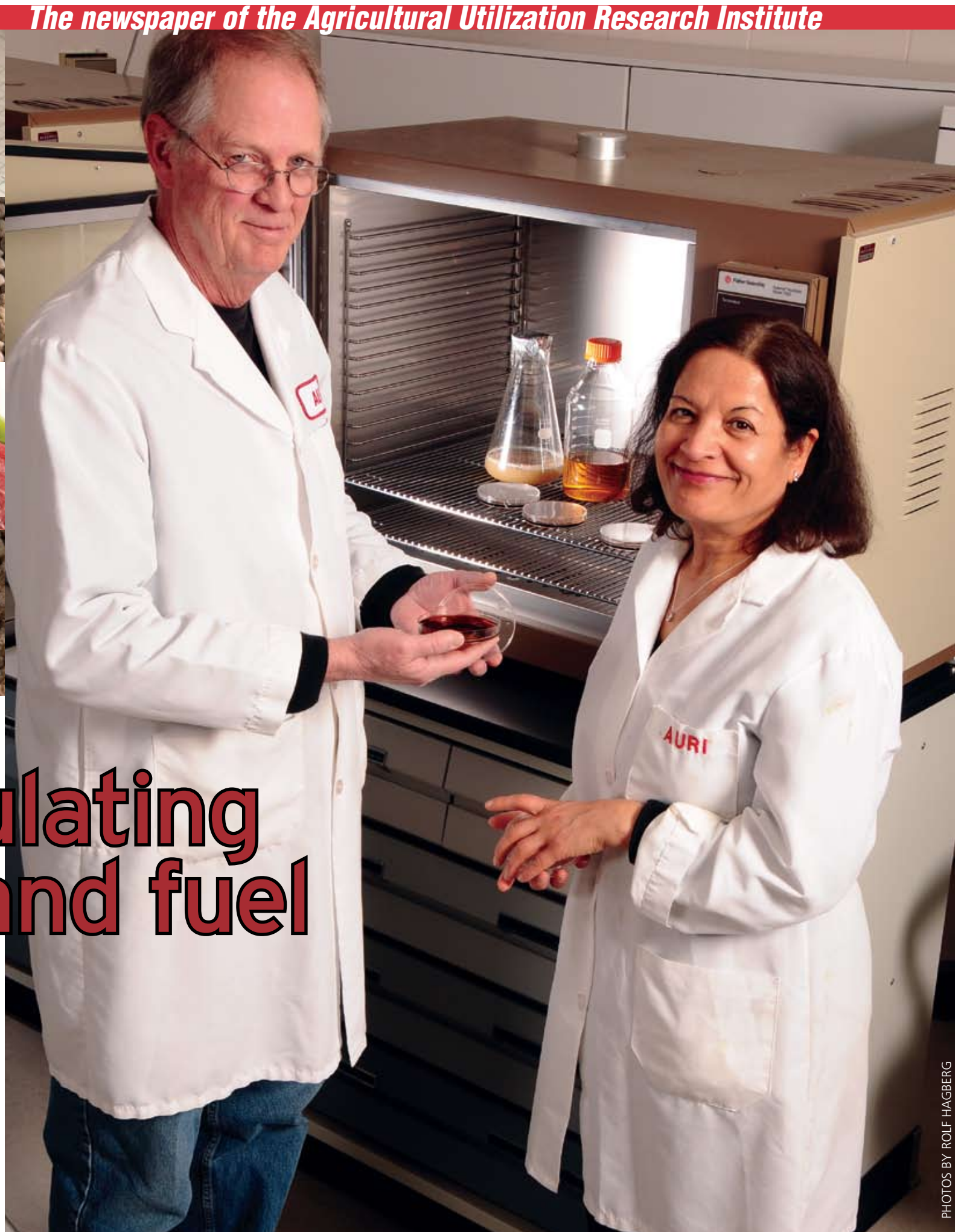
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Formulating food and fuel

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auri.org



Food for life

AURI food scientist's interest in nutrition started as a child in India, using food for medicine

BY CINDY GREEN

Crookston, Minn. — Charan Wadhawan's lifelong interest in food started as a young girl in Punjab, India; her mother used turmeric to soothe a bruise and wild celery seed to calm a stomachache. Today the AURI food scientist is an expert in nutraceuticals – food ingredients with medicinal benefits used in “functional” foods.

She has helped entrepreneurs design specialized products such as Women's Bread with soy isoflavones, and gluten-free baked goods for people with Celiac disease — along with a wide variety of other products.

“You name it; I've done it — and not just cereal products,” says Wadhawan whose product-development accomplishments include sunflower butter, barbecue sauces, frozen entrees, salsas and hot wing sauce, along with baked goods and mixes. (see sidebar next page)

Wadhawan has been AURI's lead food scientist since 1990, helping small businesses with food-product development and commercialization and managing AURI's food lab in Crookston.

“How I work is I bring the client into my lab and guide them through (the food commercialization process) so they know how to do it. Then they can call me and ask a variety of questions and do the development themselves,” Wadhawan says. If necessary, she works with the clients at their home or business site. “If there is any problem with the product, I do the trouble shooting for them.”

AT LEFT: Charan Wadhawan has been AURI's lead food scientist since 1990, helping businesses formulate, test and label new food products.

India to North America

Wadhawan says she chose food science as her career because, “I always was interested in coming up with quick and easy recipes at home. ... Nutritional value was my thing.”

She learned it from her mother. “If I had a bruise and there was swelling, my Mom would make poultice – made of flour with a lot of turmeric and some oil, cook it with a little water, then put it in a cheesecloth and hold it tight over the bruise. It did work; it helped with the swelling and the wound would heal.

“When we had stomachaches, we would take ajawain (wild celery seed), mix it with a little salt and swallow it with water. People still do that — it's a common remedy.”

Wadhawan received her master's degree in food science from Punjab Agricultural University in 1975. She moved to Calgary in Alberta, Canada to help her brother standardize recipes for his Indian restaurant, Taj Mahal, which is still open and family-owned. After a year, she was offered a cereal chemist position at the Canadian International Grains Institute in Winnipeg.

There were some cultural differences she had to adapt to. “People are very hospitable in India,” Wadhawan says. When she brought her lunch into the student lounge at Punjab, “Either we would ask other people if they would like to share what we were eating, or we would wait for others to start eating before we did.

“When I started working in Winnipeg, I noticed people would bring their snacks and lunch and just start eating,” without acknowledging anyone else in the room. “It felt strange

at the time — now I do that too,” she laughs.

She earned her Ph.D. at the University of Manitoba and worked for a short time at ConAgra before hearing about the AURI cereal position, which she accepted in November 1990.

All kinds of clients

Reflecting on 17 years with AURI, Wadhawan says the most “interesting” product she helped develop was Men's Bread, with nutraceutical ingredients such as ginseng and soy protein, designed to improve men's health. She helped French Meadow Bakery owner Lynn Gordon develop the recipe, along with several other high-protein, low-glycemic breads.

“I would formulate the recipe, then hand it to her and she would try it. ... If I was in the area, we would evaluate the product together — and do the taste test. Between Lynn and I, we would decide what to do next — whether to change the formula or keep it.”

Wadhawan is referred to clients by the Minnesota Department of Agriculture, Small Business Development Centers and other agencies — but most referrals come by word of mouth.

“I get all kinds of clients — those who are extremely thankful” to some who “think it's their right that they should get this service — that's what the government's job is.”

At the Crookston food lab, she does nutritional analysis with a software system and basic testing, such as moisture, ash, pH and sensory analysis. Her colleague, AURI scientist Ed Wene, does microbiology analysis “when we're doing shelf-life studies.” And fat and oils analysis is done at AURI's lab in Marshall.





Food-product accomplishments

Wadhawan has helped design and commercialize dozens of new food products including:

- Mixes for hush puppies, breads, pancakes, waffles, cookies, oat cakes
- Soup mixes, beef and buffalo stews, chili
- Gluten-free and flax products
- Breads: men's, women's and athlete-formula, buckwheat, fry bread, whole seed, hemp
- Cheesecakes and Baba cakes (donut holes in syrup)
- Batters and breading: fish and meat, wild rice, gluten-free
- Salad dressings
- Sauces: hot wing, barbecue, salsas
- Jams, jellies and syrups
- Sunflower butter
- IQF wild rice
- Twice-baked potatoes; veggie fries
- Frozen entrees: Indian, lamb, chicken, kabobs
- Tortillas and fillings
- Snacks: fruit smoothies, pretzels



AURI food scientist Charan Wadhawan (left) helps Lynn Gordon of French Meadow Bakery design several nutrient-rich bread varieties.

A tough business

Half of the small businesses Wadhawan has helped are still in business — well above the national average of 20 percent surviving the first five years. But a number have failed. “Unless you have some distinct advantage over other products in the market, you are not going to make it,” Wadhawan says.

Most often, businesses successfully marketing a new product already have market experience. “They may be in local stores already or they are selling on the Internet and want to add more lines.

“Some people make money in different ways ... like selling at the State Fair. I know some people making tons of money in two weeks.” Others succeed at marketing unique attributes such as handmade or hand-packaged or distinct flavors. Co-packing for others can also build profit.

Sometimes Wadhawan advises a business to nix an idea. Recently a man asked Wadhawan for advice on commercializing Mexican foods. “We talked about how many products he wanted to do. I said, ‘You need a business plan and some money upfront.’ He said, ‘Why would they want money from me? I’m giving them the idea.’ He thought a co-packer would buy his ideas.”

So she gave him co-packers names and he called back to say he was dropping the idea. “Some people live in a dreamworld,” Wadhawan says.

“Big companies have the advantage — price is the main one. Companies are going to provide what their customer wants; you can see more and more organic products coming. There are so many beverages with health advantages and all these big companies are working on that. It becomes really hard for small businesses to compete. Somehow their product needs to be better than competitors and not easily replicated.”

For example, Kari Lee baking mixes in St. Louis Park “are very successful. They grew up gradually, getting their product co-packed. Now they’re doing very well

with products in William Sonoma and they are trying to get into Target and other specialty stores.”

Entrepreneurs’ success “depends on what their goal is. Some are happy to do just enough for themselves, maybe a husband and wife team. If there are 10 couples who are making money and keeping their jobs, that keeps them out of the market competing with other people looking for jobs,” Wadhawan says.

“It keeps them busy and they make enough to be satisfied with that.” ■



Wadhawan.



PHOTOS BY ROLF HAGBERG

Cooking in Crookston

AURI’s food products laboratory is located at the institute’s headquarters in Crookston on the University of Minnesota campus. Managed by food scientist Charan Wadhawan, the lab provides small businesses and entrepreneurs with food product development services including:

New product formulation:

- Researching the product, technology to be used and raw materials needed
- Analyzing the chemistry, interaction and shelf-life of ingredients
- Standardizing ingredients
- Developing prototypes
- Sourcing commercial ingredients

Product development and improvement:

- Optimizing and improve existing products
- Reformulating to meet nutritional targets and reduce costs
- Designing, evaluating and simplifying production
- Scaling-up formula and production (i.e. from homemade to commercial)

- Determining shelf-life — assessing physical, chemical, microbiological attributes
- Evaluating sensory attributes — conducting taste tests
- Assessing nutrition — analyzing product and reformulating if necessary
- Assisting with regulatory issues — standards of identity, nutritional and basic label requirements, ingredient list, expiration date if applicable

- Packaging — determining materials and sources
- Sourcing ingredients and equipment
- Finding co-packers and licensed kitchens for production
- Assisting with production process
- Trouble-shooting — solving problems with formulation or process.

BY E.M. MORRISON

Anaerobic digestion could boost ethanol plant profits by millions of dollars — and make corn ethanol “greener.”

That’s the finding of a new AURI-sponsored study that showed the feasibility of making methane and fertilizer from thin stillage, dissolved corn solids left over from ethanol production. “Ethanol plants could potentially become energy independent if all the energy in thin stillage could be captured in the form of methane,” says study author David Rein of Rein & Associates, a wastewater engineering company based in Moorhead, Minn.

Anaerobic digestion could add \$10 million to the bottom line of a 50-million-gallon ethanol plant, Rein estimates. Digestion could also conserve water, earn valuable carbon credits, and boost corn ethanol’s energy balance by offsetting fossil-fuel use, he says.

Anaerobic digestion is a microbial process that produces methane and carbon dioxide, or “biogas,” from organic materials. Biogas is a natural-gas substitute that can be burned in a furnace or used to power a turbine for electricity.

Today, anaerobic digestion is used in many food and ag-processing industries, and for municipal-wastewater treatment. Sugar beet processors, for example, digest wastewater and use the methane to run their dryers. “It’s proven technology that’s been around a long time and is widely used,” Rein says.

Some ethanol plants already use small digesters, called methanators, to clean up their wastewater. But the ethanol industry is not yet using anaerobic digestion to generate power, says Michael Sparby, AURI project director. That could change as ethanol plants seek renewable alternatives to natural gas, he says. “I’m hearing a lot of interest in stillage digestion.”

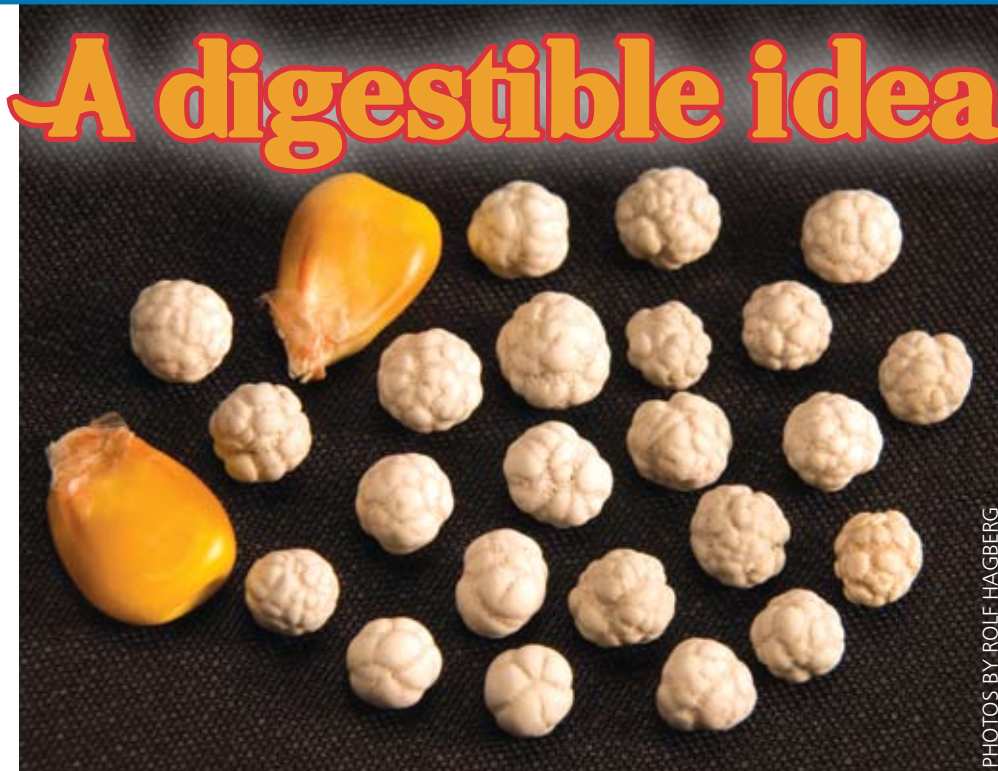
Energy from coproducts

Stillage is the slurry of corn solids and water left over after corn starch has been fermented and distilled. Ethanol plants separate whole stillage into distiller’s grains, a nutritious animal feed, and thin stillage, which is water and dissolved solids. Usually, thin stillage is concentrated through evaporation and added to the distiller’s grains.

All of these ethanol coproducts “contain significant amounts of energy that could potentially be recovered in the form of biogas, through anaerobic fermentation,” Rein says.

AURI tested both whole stillage and thin stillage digestion, with support from the Minnesota Corn Growers Association, Otter Tail Power Co., Otter Tail Ag Enterprises and the City of Fergus Falls. The research was done at the Fergus Falls Wastewater Treatment Plant, which operates a municipal sludge digester. Methane produced in the digester fuels the plant’s boilers, which can run on either natural gas or biogas. Currently, only a fraction of the digester’s capacity is being used, Rein says.

In a full-scale demonstration, whole stillage was added to the city’s digester to supplement wastewater sludge. The demonstration was



PHOTOS BY ROLF HAGBERG

Ethanol plants could use anaerobic digestion to make methane and fertilizer from corn stillage

a great success, Rein says. With the addition of whole stillage, which Rein calls an ideal feedstock, the digester generated enough biogas to completely satisfy the plant’s fuel needs.

Thin stillage tested

AURI also tested thin-stillage digestion. That may be a more attractive option for ethanol plants, Sparby says, because it preserves distiller’s grains, an important livestock feed and a major revenue source. It also saves the cost of evaporating thin stillage and drying the solubles.

A successful pilot-scale test was run from June 4 through Oct. 15, 2007 at the Fergus Falls waste treatment center. The 10,000-gallon, continuous-feed digester ran very well on thin stillage, Rein says, producing 5.4 cubic feet of methane per pound of organic material. During the 15 to 20 days in the digester, more than 80 percent of the organic matter in the stillage was converted to biogas.

The digestion process also purifies the stillage water, which can then be filtered and recycled. Water conservation is becoming an increasingly important issue for the ethanol industry, Sparby says.

Preventing ‘in-digestion’

One of the problems associated with anaerobic digestion is the formation of “struvite,” a hard, scaly compound that builds up in the digester and fouls the equipment.

Struvite is composed of magnesium, phosphate and ammonia — all important plant nutrients. Thin stillage contains very high concentrations of these chemicals, Rein says. “Struvite is a threat to effective digester

operation,” but also “presents a significant opportunity for fertilizer recovery.”

By harvesting magnesium, phosphate and other nutrients from thin stillage before it goes to the digester, ethanol plants could produce more biogas and generate another commercial product, Rein says. “It’s the struvite recovery that makes it workable.”

In experiments at the Fergus Falls water treatment plant, a portable struvite pilot plant removed 89 percent of magnesium from thin stillage, and more than two-thirds of phosphate and ammonia, Rein says. Good quality struvite pellets were produced, which could be sold as a slow release 5-21-1 fertilizer.

The dirt-like biosolids left after anaerobic digestion also make good renewable fertilizer, Rein adds, supplying about 160 pounds of nitrogen per ton.

New products to sell

A 50-million-gallon corn ethanol plant produces about 500,000 gallons per day of thin stillage. By digesting it, the plant could generate 3.2 million cubic feet of methane per day, Rein says. That would be enough to displace about two-thirds of the plant’s natural gas needs. At a natural gas price of \$8 per thousand cubic feet, the methane would be worth about \$25,000 per day, he says, or \$9 million per year.

Also, a 50-million-gallon ethanol plant could harvest 10 tons per day of struvite, which commands up to \$1,500 per ton as turf-grass fertilizer, Rein says. The plant could also market 14 tons per day of biosolids, which have a \$100-plus per acre nitrogen value and improve soil tilth like manure.

Net income from digestion, not counting

capital costs, could reach \$28,000 per day or \$10 million per year, Rein estimates. And as carbon-trading markets develop, green credits could provide yet another revenue stream, Sparby says. “If you could get most of your energy needs, plus fertilizer and water for recycling, the payback on an anaerobic digester could be pretty quick,” Sparby says — as fast as five years.

Minnesota plant interested

Today, no U.S. ethanol plants use thin stillage as the sole feedstock for anaerobic digestion, Sparby says. A few are digesting whole stillage or combining thin stillage and other organic material. An Idaho ethanol plant, for example, is building a full-scale digestion system that will run on thin stillage plus manure.

In Minnesota, Otter Tail Ag Enterprises, a 55-million-gallon corn dry mill in Fergus Falls is interested in stillage digestion. The company began making ethanol in early 2008 and is now looking for renewable alternatives to natural gas. “Our goal is to be a low cost producer and reduce our fossil fuel consumption,” says CEO Kelly Longtin.

This year, Otter Tail will spend about \$13 million on natural gas — its second-largest operating expense after corn. “We don’t see natural gas prices going down a lot either,” Longtin says.

He was pleased with AURI’s stillage-digestion trial results. “We like the amount of biogas it produces and the amount of renewable fertilizer that would come off it,” he says. “That’s a real opportunity, especially when we see what’s happened to fertilizer prices.”

Stillage digestion would also qualify for more carbon credits than other types of renewable power, such as biomass combustion, he says. “Carbon credits could be a very important piece of this. That market in the past has traded at \$1.50 to \$4 per ton.”

On the down side, he says, anaerobic digestion is “a biological process that can get disrupted. You can ‘kill’ a digester.” And digesters have high up-front costs. Longtin estimates it would cost at least \$20 million to build a full-scale digester for the plant.

But overall, Longtin says, “we’re excited about the results of the digestion study.”

To read Rein and Associates’ report on corn stillage digestion and struvite production go to www.auri.org ■



Struvite, a nutrient-rich ethanol byproduct, could be recovered from processing waste and sold for fertilizer; the remaining thin stillage could be digested into methane for powering plants.

Carving out more value

The flat iron steak, above, is one of several inexpensive but tender and flavorful cuts being promoted by the National Cattlemen's Beef Association.

New beef cuts offer consumers inexpensive yet tender and flavorful entrees

BY DAN LEMKE

Marshall, Minn. — Cattle producers are finding more ways to carve value out of beef.

Two new cuts — the chuck-eye steak and boneless country-style short ribs — were unveiled at the National Cattlemen's Beef Association (NCBA) convention in February. The steaks and ribs are tender portions of meat carved from less expensive cuts for added value.

The new cuts join the ranch cut and flat iron steaks, which the beef council started promoting several years ago as tender but inexpensive beef cuts.

"Obviously the more steaks you can sell the more value you bring to the beef carcass," says Clint Gehrke, AURI animal products scientist in Marshall.

For years, Gehrke and others have been promoting new value-added steaks that previously had been sold as ground beef or roasts.

An NCBA test panel ranked the flat iron second only to the tenderloin in tenderness. While the tenderloin wholesales for more than \$9 a pound, flat iron steaks wholesale at just over \$2 a pound and ranch cut steaks for about \$1.50.

The 6-inch long flat iron is cut by removing a tough connective tissue that runs through the top blade muscle. Because it comes from the shoulder, it is more flavorful than a tenderloin, which comes from under the back bone.

AURI has designed educational posters for consumers and meat cutters. Gehrke and Tony Mata, an NCBA consultant, demonstrated how to cut the steaks at the annual Minnesota Association of Meat Processors convention in March. He also exhibited the new cuts and gave out samples at the Twin Cities Food & Wine Experience and the Upper Midwest Foodservice and Lodging Show.

Tyson Foods, the world's largest protein provider, announced at the NCBA convention that it will wholesale flat iron and ranch steaks, which will increase their availability in grocery stores.

"This is a good situation for consumers who want a good steak at a good price," says Gehrke. "It's also good for beef producers because if we have more steaks, we have more value."

From 1990 to 2001, the average American consumed between 60 and 70 pounds of beef per year. According to NCBA, 63 percent of the beef sold in the United States is ground beef, 16 percent steak and 12 percent roasts. However, 45 percent of a beef carcass' value is in the steak, compared to only 27 percent for ground beef.

NCBA check-off funded research has analyzed dozens of individual muscles from lower-value cuts such as the chuck and round. Tests showed several were tender enough to be sold as steaks, rather than as ground beef or arm and shoulder roasts. ■

Meet the meat specialist



Gehrke.

Minnesota has about 25,000 cattle producers, according to the Minnesota Agricultural Statistics Service. AURI's Clint Gehrke is one of them.

During the workday, Gehrke is AURI's animal products specialist who helps develop value-added meat products. He also operates AURI's USDA-inspected meat lab in Marshall.

Nights and weekends, he feeds a small herd of cattle on his father-in-law's farm near Milroy.

Gehrke hasn't strayed far from his bovine roots. He grew up working at his grandfather's

corn, soybean and beef cattle farm near Pipestone. In 2005, after graduating from South Dakota State University in Brookings with a degree in animal science, he began working for AURI.

"It's rewarding to help develop new value-added products or to help clients solve problems," Gehrke says.

Gehrke has provided assistance to dozens of Minnesota meat processors trying to develop and test new products. For example, he helped hog producers develop nitrate-free cured ham and bacon. He identified and tested the

proper process for making shelf-stable meats, seasoned jerkies and sausages. And Gehrke has conducted taste panels, using impartial focus groups to give producers feedback.

Besides product-development assistance, Gehrke also teaches a Culinology® class at Southwest Minnesota State University and provides information to the state's meat processors. He was named to the recently-formed Minnesota Food Safety and Defense Task Force, which will work on policy, training and ways to deal with food recall issues across the state. ■

School market going small

Former self-ascribed 'corporate guy' now selling healthy

BY CINDY GREEN

Hopkins, Minn. — What's a high school student to choose? A sugar-laden carbonated beverage with no nutritional benefits? Or a frozen smoothie made with real fruit, juice and dairy?

Robert Carr hopes more students and schools choose smoothies. In 2006, the "corporate guy" turned entrepreneur founded Healthy Holdings, makers of Fruchi fruit and dairy smoothies for schools, fundraisers and concessions. Carr's next target market is upscale grocers.

While a Fruchi costs more than soda, many schools are removing pop machines or locking them during the school day. Administrators are trying to make up lost revenue with healthy alternatives.

"What we have is a portable, convenient, real-fruit smoothie ... no fat, no cholesterol, 100-plus percent daily C, more than a serving of fruit, 140 to 160 calories," Carr says. The 8-ounce serving "is really a pretty filling snack; it can be a meal replacement. ... Most novelties in stores are three ounces or less ... and some are just sugar water."

Direct to school

Healthy Holdings markets to middle and high schools — an "easier sale" than elementary because older students have more school-lunch purchasing options.



A Healthy Holdings employee scoops frozen yogurt into blenders that will mix fruit and dairy to make smoothies.

Fruchi's market launch coincided with a new federal mandate that schools must design wellness programs if they participate in the national school lunch program. "We marketed Fruchi as a key component," Carr says. "As schools were losing soda revenue, they looked to à la carte products like ours" to replace lost sales.

"Our product is the only one like it that I've found," Carr says. Fruchi comes in four flavors — Razz Pizzazz, Strawberry Escape, Berry Blitz and Caribbean Craze — packaged in ready-to-eat pouches. While most of the fruit comes from the West Coast — strawberries, peaches, blueberries, papaya — Fruchis are also made with apple juice.

"We would like to get apple juice from Minnesota," says Carr who is investigating a local source. "The issue is, can we get the quantities we need, delivered at an acceptable price?" The fruit and juice is blended with frozen yogurt and sherbet.

Small batches

Carr's office and production facility in Hopkins "is a pretty simple operation" with six commercial blenders retrofitted from retail operations and filling and sealing equipment, Carr says. Through a Hopkins school vocational program, special education students help with labeling.

The first Fruchis Carr marketed were made fresh daily. "We made them up the same day the schools took them. Most wanted deliveries twice a week. Each day we packaged them in styrofoam cups and delivered no later than 10:30 to be there before lunch hour.

"As we grew, the whole window got more difficult." The initial 12 schools increased to 20 by the spring of 2007. "We struggled with this idea of making and delivering a fresh product every day."

Frozen and new

Carr went to work designing a frozen product in a simple, environmentally-friendly plastic pouch with a tear-off top that he has filed a patent for.

Carr received some assistance with developing his business. For example, he meets regularly with marketing and financial consultants at the University of St. Thomas Small Business Development Center. He also found AURI food scientist Charan Wadhawan who helped with product development, nutritional analysis, packaging, labeling and "making sure we knew what we needed to do."

"For someone like me starting this business, I have all this corporate experience, but a lot

of that isn't relevant when you're in a hands-on mode. ... It's nice to have organizations like AURI. ... I must say I've been pleasantly surprised at how many resources there are (for small businesses)."

The new Fruchi "is frozen, but if you let it stand 10 or 15 minutes and knead it a little, it's exactly the texture of a fresh fruit smoothie." It's also easier to distribute and has a longer shelf-life. "Before, if schools didn't get rid of all the fresh smoothies the same day, they could freeze them, but the quality deteriorated."

Adapting markets

Although Carr has expanded his customer base to about 30 schools, the pouches aren't selling quite as well — per school — as the fresh smoothies. "It's become more of a frozen novelty now; before it was more like a beverage. By the time kids buy their regular meal and a beverage and a Fruchi, it's more expensive.

"Also, it's less of a phenomenon now ... and has become just a regular part of the school's à la carte offering. I'm fine with that because in many ways our growth opportunities will be outside the schools, and they still love our product."



Robert Carr left the corporate world to go into the fruit smoothie business. After a short stint with a retail company markets directly to schools.

oothie

ny fruit and dairy Fruchis to high school students

Healthy Holdings charges schools \$1.20 per Fruchi and schools set the retail price — averaging \$2 to \$2.25 each. “There is little prep or clean up with our product, and schools make up some of the money they use to get from pop sales ... (pop) markups are astronomical.”

“I’m not getting rich by any means,” Carr says. “But if it takes off, my costs will be offset by higher sales and lower labor and ingredient costs.”

A natural outgrowth of the school market has been team fundraisers, sports concessions, and parks and recreation facilities. Three Hennepin County parks sold Fruchis last year at concession stands. “Obviously there wasn’t

any promotion,” but popularity grew by word of mouth, Carr says. “When parents try our product, we invariably get e-mails wanting to know where they can buy it.

“Hopefully we can get kids to sell products as a fundraiser and get Fruchis in the hands of parents. We’re going to push a lot harder to get more concession business and sports venues, concerts. It’s a grass roots effort.”

Corporate beginnings

Carr’s 24/7 entrepreneurial lifestyle is a long way from the corporate world he left eight years ago. “I started with Pillsbury in finance. ... I was CFO for Haagen Dazs, then for Northgate Computer, then Redline Healthcare,” where Carr was CEO for five years until the company was sold. “I decided to say goodbye to the big corporate world.”

“I did some adjunct teaching at the University of St. Thomas.” In 2003, Carr became interested in a fruit-smoothie retailer in California that was starting to franchise its business. He purchased Minnesota territorial rights and opened a smoothie store at the Mayo Clinic in Rochester, Minn.

However, faced with retail challenges, marketing a product unfamiliar to Minnesotans, and the restrictions of a corporate franchise, Carr decided he didn’t want a storefront and sold back the franchise rights. “When you have a new franchise, it’s unproven. They’re telling you how to do things, but they’re not out there on the front lines,” Carr says.

He liked the smoothie product, however, and their growing popularity with teenagers. “Smoothies are not a fad. They are a long-term and rapidly-growing trend,



Fruchis, in four flavors, are fat-free and about 150 calories per 8-ounce serving

a product that especially appeals to younger people.”

“Rather than this retail business, which is a challenge to operate, I decided to start a wholesale business, produce larger quantities and cater to schools.” Carr launched his new company, Healthy Holdings, in the summer of 2006 and immediately started marketing to schools.

“Everything multiplies what we had in our retail store where we would sell 200 to 300 a day. Now we do 1,000 to 1,200 a day for schools.” As his own boss, Carr says he is “doing better with ingredient sourcing, packaging and the freedom.”

Heading home

Ultimately, Carr wants Fruchis in home freezers. To gear up for retail, the company is enhancing the product’s look. “We have designed a sleeve, like you get with a coffee cup, to slip over the pouch,” which is easier to hold than the cold plastic, Carr says. “And it serves as a push-up tool.”

“When we’re ready, Charan will help us reformulate our existing product” for retail and meet labeling requirements. “We are going to be working on healthier smoothies, using more functional (health-promoting) ingredients,” Wadhawan says. “And we’ll be working on more flavors.”

In the meantime, the company is upgrading its marketing with new label graphics, marketing materials and an upgraded Web site. Laurie Bauer recently joined Healthy Holdings as sales director to lead the new marketing effort.

“An upscale, local chain like Lunds/Byerly’s or Kowalskis is where we hope to go as a first step. They seem to support Minnesota companies and like innovative new products.”



Fruchis are packaged in a simple plastic pouch with a tear-off top.



PHOTOS BY ROLF HAGBERG

franchise, he decided to produce his own fruit and dairy Fruchis that his

Where are they now? Updates on past features.

POWER RENEWAL

A Minnesota cooperative returns to its founding vision of biomass energy

BY E. M. MORRISON

Priam, Minn. — A Minnesota cooperative has a new “power point.”

Minnesota Valley Alfalfa Producers started plans to generate electricity from alfalfa stems 14 years ago. But after investing six years of effort and millions of dollars, the farmer-owned cooperative was forced to pull the plug on the project when its partners dropped out.

Despite its rocky start, MnVAP went on to become one of the nation's largest alfalfa pellet mills, says Montevideo farmer Keith Poier, MnVAP chair. And now — as Minnesota pursues ambitious renewable-energy goals — MnVAP has returned to its founding vision of biomass power. The cooperative wants to supply biomass fuel pellets to Minnesota's growing renewable-energy sector.

“MnVAP members initially signed on with the intent of being a renewable energy company,” says Kim Larson, a Willmar farmer and consultant who helped organize the co-op in 1994, “and they are once again looking at renewable energy opportunities.”

Late last year, the cooperative received a \$1 million renewable-energy grant from the Xcel Energy Renewable Development Fund. MnVAP will use the grant money to test a new technology for grinding and drying high-moisture agricultural fibers, such as wood, native grasses and crop residues.

“Innovative and new renewable technologies, such as solar and biomass, have trouble competing with conventional energy in the marketplace,” said Scott Wilensky, Xcel Energy acting vice president of regulatory and government affairs, in a written statement. “The fund's objective is to remove barriers to entry of new renewable-energy technologies.”

MnVAP will work with AURI and Canadian equipment manufacturer First American Scientific Corporation to test a biomass pulverizing method known as a kinetic disintegration

system or KDS. KDS was originally developed for the mining industry, Poier says. Now it's being used by other industries that need to grind and dry materials before condensing them into pellets.

KDS combines grinding and drying into one operation, eliminating several processing steps and lowering fuel use, Poier says. With this new technology, MnVAP hopes to cut its manufacturing costs in half, he says. That “would allow them to be competitive in a biomass industry,” says Al Doering, scientist at AURI's coproduct lab in Waseca.

AURI, which helped the co-op get started in the early 1990s, will assist MnVAP in evaluating this new technology. “We'll help them compare it to their current process,” Doering says. “Some of the things we'll be looking at are pellet quality, moisture, output and energy savings.”

A good fit for MnVAP

Providing feedstocks for renewable power would be an ideal fit for the farmer cooperative, Doering says. “They've been in business a long time, and they have years of experience in collecting and processing long-stem biomass.”

Today, MnVAP manufactures 40,000 tons of alfalfa pellets annually and ships its

products to feed mills all over the United States, Poier says. Alfalfa is a high-protein staple of livestock diets.

Like the feed industry, the developing biomass-power industry will need cost-effective ways to handle voluminous, perishable plant materials, Poier says. “These materials are very expensive to transport and touchy to store. We're already in the business of processing a bulky raw material so it can be densified and shipped across the country to an end user.”

MnVAP has another big advantage, too, says Larson, the Willmar consultant who is coordinating the co-op's biomass project. “They are a farmer-owned co-op with 141 shareholders.” MnVAP growers currently supply the co-op with 10,000 acres of alfalfa. In the future, these farmers could also provide the dedicated energy crops that will be needed, Larson says. “Not only can they process biomass, but they have the nucleus of growers to supply it, too. That's their biggest asset.”

MnVAP members “farm up and down the Minnesota River Valley and the Red River Valley,” Poier adds. These environmentally-sensitive

areas could benefit from perennial energy crops, “plants like alfalfa that are good for the land and water,” he says. “That's an important part of this — to improve the environment.”

Markets emerging

Last February, Minnesota passed landmark legislation that requires state utilities to generate a quarter of their power from renewable sources by 2025. The goal, called “25 by 25,” is one of the most ambitious in the nation, Doering says, and it's encouraging the development of biomass markets.

For example, municipal utilities in Willmar and New Ulm are looking into co-firing biomass and coal. Ethanol plants are also interested in gasifying or combusting biomass to produce “greener” transportation fuel. Already, three Minnesota ethanol plants are generating biomass power to run their operations. In the future, more companies “will need densified material,” Doering says, creating opportunities for suppliers such as MnVAP to fill the need.

In 1994, when MnVAP formed, “We were way ahead of our time in so many ways,” says Poier, who has served on the co-op's board since 1999 and been a member since its start. After the first biomass-power initiative collapsed, shareholders could have thrown in the towel, “but we held together.”

The company has struggled to be profitable in a thin-margin business, Poier says, but now, “we've gotten to the point where we're ready to stretch ourselves.” He adds, “I really think this is an opportunity that will pay benefits,” not only for MnVAP, but also “for our communities, our farmers, our state and the nation.” ■



Stabilizing force Antioxidants extend biodiesel's shelf life, AURI tests show

BY DAN LEMKE

Marshall, Minn. — Antioxidants not only keep humans healthy, they could extend the life of biodiesel.

As part of an alternative-fuel evaluation, AURI chemist Ranae Jorgenson tested various soybean oil and biodiesel samples to determine shelf life — how long they could be stored before breaking down. “Fuel breakdown will affect performance,” Jorgenson says. “As renewable-fuel standards call for increased use of biodiesel, long-term stability needs to be addressed.”

Jorgenson evaluated oxidative stability, fatty acid composition, calculated iodine value, calculated free fatty acid and moisture. The biodiesel and oils were tested for six months, the maximum length that fuels are typically stored. Jorgenson added tertiary-butylhydroquinone (TBHQ), an antioxidant stabilizer, to some of the samples. Stabilizing agents are generally added to fuels by refiners, not consumers.

“The addition of stabilizing agents in both the oils and biodiesel significantly inhibited degradation,” and may increase the length of optimal use, Jorgenson says.

“Untreated oils can be highly oxidative,” says Max Norris, AURI director of projects and technology. “The use of TBHQ has been promoted in the industry and these tests confirm that it works. That's important because we want to ensure that vehicle performance won't be impacted when consumers use biodiesel.”

Shelf-life testing results will be presented at the American Oil Chemists Society annual meeting in Seattle, Wash. in May. ■



Jorgenson.

PHOTO BY ROIF HAGBERG

State embraces energy policy

Editor's note: Minnesota's Renewable Energy Roundtable is a multi-organization group facilitated by AURI to develop action plans that move the state's energy industry forward. Participants have identified five areas where further development is needed. Public policy and awareness is the focus of this article, the first in a series.

BY DAN LEMKE

St. Paul, Minn. — The 2007 Minnesota legislative session swept in ground-breaking energy policy.

The Next Generation Energy Board was created to develop policy for biofuels, bioenergy and renewable-energy technology.

Legislation also established AURI as convener of the Minnesota Renewable Energy Roundtable, which AURI initiated in September 2006. Representatives from research, industry, higher education, state government, agriculture, utilities and economic development meet quarterly to discuss ways to advance renewable-energy opportunities in Minnesota.

More than 200 individuals representing 60-plus organizations have participated in the Roundtable. The sessions provide opportunities for generating ideas, collaborating, and identifying impediments

to energy development. Talent development, financing, basic and applied research, infrastructure and public policy and awareness are the five overarching initiatives participants identified.

Policy-driven industry

The 2007 legislature's energy policy changes were of "historic proportions," says Mike Bull, deputy director of the Office of Energy Security and leader of the Roundtable public policy and awareness team.

He points to major legislative measures such as aggressive renewable electricity standards, a statewide energy goal of 25 percent renewable energy by the year 2025, doubling the energy efficiency standards of utilities and a reduction of greenhouse gas emissions by 2050. "Passing any one of those would have been big," Bull says, "but to do them all in one session is really historic."

Establishing a renewable-energy facility is often policy driven because economics can keep a fledgling industry from being competitive.



Minnesota's Renewable Energy Roundtable

Action Now! Initiative

"The marketplace doesn't necessarily capture all the value renewable energy offers, so you either have to buy down the costs or develop another mechanism," Bull says. "In the long run, we think carbon regulation will become the umbrella that captures all the costs, so eventually we may not need to have as many policies in place to facilitate renewable-energy development."

Blending perspectives

Roundtable policy and awareness participants include college instructors, business operators, legislators, engineers and even sociologists. The broad perspective generates ideas others may not have considered.

Bull says the Roundtable originated the idea of creating the Minnesota Office of Energy. In January, Governor Pawlenty created the office in the Department of Commerce to be an independent, central resource for energy issues.

Another Roundtable-generated idea is creating Green Star Community designations that will be given to cities and counties that set and meet energy development and conservation goals.

"These are examples of how ideas put forward by a collaborative group can lead to real change," says Teresa Spaeth, AURI executive director. "The purpose of the Roundtable is not only to get everyone interested in renewable energy working together, but it's also to develop real actions that benefit Minnesota."

"When it (the Roundtable) first started, I thought it would be fun," Bull says. "I've been surprised by its level of value. The mix of people that come to these sessions isn't found anywhere else. There is a blending of perspectives ... and it leads to a stronger overall fabric." ■

For Roundtable-event alerts, e-mail Valerie Gravseth at vgravseth@auri.org

Striking a cord with native grass

Researchers evaluate little-known grass that may hold potential for biomass fuel

BY DAN LEMKE

Crookston, Minn. — This past summer, AURI scientist Edward Wene and other researchers investigating biomass sources for energy, were harvesting switchgrass from a test plot near Fertile, Minn. They noticed an adjacent stand of tall, dense grass — prairie cordgrass, which had been planted by a local company for seed. The team got permission to harvest a sample for yield comparison.

The results took them by surprise — they may have uncovered a potential crop for making cellulosic ethanol and other biofuels.

Wene, Wendell Johnson of the University of Minnesota-Crookston and Bill Berguson of the Natural Resources Research Institute have been establishing switchgrass test plots to compare fertilizer rates and biomass yields, so producers can assess production costs. In 2007, plots near Thief River Falls, Minn. averaged 2.5 dry tons of biomass per acre while the Fertile fields averaged 4.8 tons.

Meanwhile, the cordgrass plantation averaged 6.8 dry tons per acre.

"This wasn't a discovery of an unknown crop, but nonetheless the yields were impressive," Wene says. "Now we need to find out if that was just a really good field — last year was a very good year (for growing cordgrass) — or if we're onto something."

Building on biomass

Developing cellulosic ethanol from biomass, including crops like switchgrass, is gaining tremendous national attention. Wene says switchgrass became the biomass focus crop in the 1970s because it can be grown nearly everywhere in the country. That doesn't mean it's the best crop for producing biomass. "Other plants may do better regionally," Wene says.

Prairie cordgrass is a native grass that can grow 6 to 8 feet tall. It's found throughout

the Northeast, Great Lakes and the Midwest — typically in poorly-drained and wet soils, ditches, marshes, streams and potholes. Wene says it's not a suitable forage crop but the impressive northern Minnesota yields are generating interest in evaluating it as a biomass-fuel crop.

"We can't say that it's the crop of the future because at this point all we can verify are yields from one field." But, Wene adds, "they are higher yields than we've seen from anything else in this area."

Wene cautions that yields aren't the whole story. Little is known about the cost of production, biomass storage, seed viability, weed control or a host of other production issues. But prairie cordgrass appears to be a biomass crop that merits further exploration. ■



Wene.

PHOTO BY ROLF HAGBERG

Elsewhere in ag utilization

BY DAN LEMKE
CARTOONS © UNCLE HYGGLY, woundedcoot.com

Editors note: Elsewhere provides news from around the globe on new uses for agricultural products. Please note that ARS is the research arm of USDA.

Surfin' on soy

Beach bums may be catching their next wave on soyboards. Homeblown, a San Diego company, produces surfboards with Biofoam, plastic foam made with up to 50 percent ag products, including soy. The soy foam exhibits superior hardness and has a finer, more uniform cell structure than petroleum foam. The technology used to make surfboards is also used for architectural models, insulation and other foam products.

From: Biobased Solutions
January 2008

Power-packed cranberry

Soon heaping extra cranberry relish on your Thanksgiving dinner plate could make your holidays healthier. USDA-ARS researchers are crossing several cranberry varieties to produce fruit with more anthocyanins, chemicals high in antioxidants. Cranberry hybridization started only recently. The new varieties are not yet commercially available.

From: USDA-ARS
January 8, 2008

Jumbo jet biofuel

Virgin Atlantic has carried out the world's first flight of a biofuel-powered commercial aircraft to show it can produce less carbon dioxide than normal jet fuels. The February 24 Boeing 747 flight from London to Amsterdam carried only pilots and several technicians who are



analyzing emissions data. The biofuel was made partially from coconut and babassu oil.

From: Soyatech.com
February 25, 2008

A shot of rice

A Japanese research team has developed cholera vaccine from rice that is genetically altered to include cholera bacteria protein. Led by researchers at the University of Tokyo's Institute of Medical Science, the method for impregnating rice with protein could be used with other bacteria to create more edible vaccines.

From: BiobasedNews.com
February 22, 2008

Buzz off

While many pesticides are toxic to insects and humans, a molecular pesticide developed by ARS scientists may deter mosquitoes and other pests without risking human health. Nucleic acid, the molecular pesticide's active ingredient, allows scientists to target and interrupt genes

essential to the insect's survival. Chemical pesticides often impact physiological systems shared by humans and pests. The new technology only targets pest genes.

From: USDA-ARS
December 20, 2007

Hop to it

While hops may be best known for their beer-brewing role, their value is expanding. Because of their natural anti-microbial properties, hops are being used more in sugar processing, tea and animal feed. Oregon ARS researchers have developed a new hop variety with an extremely favorable acid profile. It could potentially replace formalin in sugar processing and antibiotics in animal feeds.

From: USDA-ARS
January 3, 2008



Healthy paint

City College of New York and Rice University researchers have developed a technique for producing anti-microbial paints that could help hospitals, homes and offices fight germs. The nontoxic, vegetable-oil-based paints are embedded with antimicrobial silver nanoparticles to curb bacterial growth — the main cause of infection and disease.

From: BiobasedNews.com
February 22, 2008 ■



AURI news briefs

Wagner joins AURI staff

AURI's newest staff member comes with an international flair.

Jennifer Wagner has joined AURI as project development director in central Minnesota.

For the past six years, Wagner served as executive director of Global Outreach, which provides professional and personal development opportunities through international exchange programs for individuals interested in agriculture and rural life.



Wagner.

Wagner is also bookkeeper and secretary at the Litchfield, Minn. dairy farm where she grew up. She farms with her fiancé near Cold Spring, raising replacement Jersey heifers for her family's 220 head dairy as well as beef, sheep and chickens.

Wagner earned a bachelors degree in agricultural economics from the University of Minnesota and masters from Humboldt University in Berlin, Germany.

"I have been interested in the work AURI has been doing for many years now and I am pleased to have the opportunity further value-added agriculture in Minnesota," Wagner says.

AURI project development directors work directly with clients and partners to develop value-added ventures. Wagner has worked part-time for AURI since February and starts her fulltime position in April. ■

Balancing act

BY TERESA SPAETH

"When you're trying to create things that are new, you have to be prepared to be on the edge of risk."
Michael Eisner, former Disney CEO

"When you innovate, you've got to be prepared for everyone telling you you're nuts."
Oracle Corporation founder Larry Ellison

Innovating isn't easy. American companies spend billions and countless hours trying to come up with the next big breakthrough — whether developing a digital gadget, slick software or a new way to use agricultural products.

AURI has an 18-year track record of working on innovative and sometimes risky ventures. Many have resulted in new products reaching the marketplace. It's not always easy or speedy but often worth the risk.

For example, more than 15 years ago AURI staff started working on soy-based diesel fuel for underground-mining operations. It wasn't until September 2005 that all Minnesota retailers began providing diesel with a 2% biodiesel

blend. Numerous detractors along the way said the fuel could never be successfully developed. Now there are multiple biodiesel facilities in the state, proving it could be done.

It often takes many months, even years, to move from an idea to a marketable product. Sometimes it doesn't happen. AURI was created to be innovative and that means not every project or initiative will result in market success. But AURI mitigates the risk by working with existing businesses, entrepreneurs and cooperatives to determine a value-added venture's technical and market feasibility.

Even in cases where the best decision was to end the project, something was learned that could be applied to future ventures.

We fully expect that not all of our projects will yield commercial success. Some people may tell us we're nuts —that may be OK. But AURI will continue to support innovation and moving Minnesota ag products into new arenas. ■



Spaeth.

A nonprofit corporation created to strengthen rural Minnesota's economy, AURI helps businesses respond to market opportunities with new and value-added uses for agricultural goods. The Institute builds working partnerships with business innovators, agricultural groups and researchers, and provides technical support to clients conducting new product research and development.

AURI programs are available to legally-organized businesses or cooperatives with projects that have the potential to create new uses or new markets for Minnesota agricultural commodities. AURI assistance is designed for the early stages of a product's life cycle, while an element of feasibility is yet to be determined.

Project proposals are evaluated on the following criteria:

- Innovation/uniqueness
- Market viability
- Use of Minnesota commodities
- Number of farmer-producers impacted
- Amount of value added from further processing
- Economic impact
- Cost savings

Programs are designed to assist with:

- Identifying emerging value-added opportunities
- Developing innovative commodity-based products
- Developing production processes for feasible products
- Promoting products developed with AURI technical assistance
- Providing resources to bring new products and processes to the marketplace

Assistance may include:

- Access to AURI's scientific and business staff
- Access to laboratory and pilot plant facilities
- Product development and feasibility testing
- Process evaluation and improvement
- Technology transfer and applied research
- Business needs evaluation
- Links to available resources
- Potential for grant funds to qualifying applicants

AURI provides resources proportionate to the project's impact. Smaller-impact projects may be eligible for technical assistance only, while projects with industry-wide impact may be eligible for financial assistance.

AURI Facilities

AURI operates several laboratories:

- Coproducts Utilization Laboratory and Pilot Plant, Waseca
- Fats and Oils Laboratory, Marshall
- Meat Laboratory, Marshall

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AURI ag innovation quiz

- What is struvite?**
 - a. Cone-shaped mineral formations in caves
 - b. A biosolid formed from ethanol leftovers
 - c. A breakfast cereal
- Fruchis are:**
 - a. Fruit and dairy smoothies
 - b. Short-haired dogs
 - c. A 1960s British band
- How many tons of alfalfa pellets are produced annually by MNVAP?**
 - a. 100 tons
 - b. 1,500 tons
 - c. 40,000 tons
- What fuel-based use has been found for antioxidant TBHQ?**
 - a. Biodiesel stabilizer
 - b. Fuel filter cleaner
 - c. Artificial coloring
- What was the tonnage yielded by a test field of prairie cordgrass?**
 - a. 3 tons per acre
 - b. 6.8 tons per acre
 - c. 11.1 tons per acre
- What energy policies did the Minnesota Legislature establish last session?**
 - a. Reduce greenhouse gas emissions by 2050
 - b. Double utilities' energy efficiency standards
 - c. Use 25 percent renewable energy by 2025
 - d. All of the above
- What biomass could fuel ethanol plants?**
 - a. Chicken feathers
 - b. Native prairie grass
 - c. Malting waste
- What food ingredient can help heal bruises?**
 - a. Turmeric
 - b. Turnips
 - c. Catnip



Answers: 1.b, 2.a, 3.c, 4.a, 5.b, 6.d, 7.b, 8.a

ABOUT AG INNOVATION NEWS

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An entrepreneurial farm family produces uncommon commodities



Eric Kreidermacher, above, and his brother Paul market biomass boilers that burn wood pellets and corn. They recently purchased two mills to make their own biomass pellets to heat their farm's greenhouses.

BY DAN LEMKE

Altura, Minn. — The Kreidermachers aren't your typical southeast Minnesota farm family. Besides hogs, they raise poinsettias, vegetables, bedding plants and perennials on a 160-acre farm — year round. Now the family is adding fuel pellets to their operation's production list.

Edward and Joyce Kreidermacher founded Pork and Plants in the 1980s. Their children Eric and Maria joined the family business several years ago. Today, the farm includes 65,000-square-feet of greenhouses, partially heated by two biomass boilers that burn wood pellets and corn.

Eric, with his brother Paul, also operates Alternative Energy Systems, which markets commercial and residential biomass boilers. They are working with AURI to develop pellets made from local resources such as corn stover, soybean straw and native prairie grasses to fuel the boilers.

Prairie fuel

The Kreidermachers see acres of marginal farmland in southeastern Minnesota's rolling bluff country that may be better suited to native prairie grasses than conventional farming. Those acres could provide the biomass needed to produce fuel pellets.

About a year ago, the brothers purchased two large pellet mills. This spring, they expect to begin producing pellets to fuel the Pork and Plants greenhouses.

"There's been a lot of trial and error, but you learn as you go and find the people who know what you need to know," Eric says. "We want to be self sufficient and produce fuel for ourselves and others."

The Kreidermachers are "ahead of their time," says Alan Doering, AURI associate scientist. Doering has been working with the Kreidermachers in AURI's coproducts lab in Waseca to develop biomass pellet blends using crop residue and grasses. "This project is progressive and focuses on many of the issues AURI has been involved with including biomass utilization, densification and energy independence."

The Kreidermachers have already planted 20 acres of their farm to prairie grasses as it takes two to three years for native grasses to fully establish. But the perennials do not require any inputs once established and can be harvested once a year, then chopped and made into pellets.

Eric says the Department of Natural Resources may consider opening some state grasslands to biomass harvest as an alternative to prescribed burns. The Kreidermachers may also source biomass and prairie grasses from neighboring farmers.

Entrepreneurial roots

Eric says it's his family's nature to take atypical approaches to business. His parents purchased the family farm, just outside Altura in Winona County, in the late 1960s. They raised dairy cows and later added hogs.

Joyce was interested in growing vegetables and plants but couldn't always find varieties she wanted at area greenhouses. So she researched seeds and sourced her own.

With help from their four children, the Kreidermachers expanded and soon were selling plants to friends and neighbors.

In 1985, the family named the business Pork and Plants and added a large greenhouse. The controlled environment offers safety from the icy outside air for thousands of bedding plants, vegetables and flowers. Since the Kreidermachers raise plants year-round, the protection is expensive.

"About half of a year's worth of fuel consumption is used just raising poinsettias," Eric says. "There's getting to be fewer people who raise them because of that."

Building off biomass

The Kreidermachers added biomass boilers to lower propane costs about five years ago, before most people were serious about biomass energy. Burning wood pellets and corn "has cut our costs in half," Eric says.

"We jumped into the boilers without a lot of information. There was a lot of trial and error, but it's in our nature to see what's out there that's new and better."

Powering the greenhouse operation consumes about 20,000 bushels of corn or 500 to 600 tons of pellets, Eric says. Kreidermachers' two pellet mills could produce significantly more fuel than Pork and Plants will use. They envision one mill producing pellets for commercial boilers and the other for residential burners. They are also considering a mobile unit for in-field fuel production.

Eric says they are still on a learning curve. "A lot will be figured out as we go," he says. "We're doing it on a smaller scale by powering our own operation first and working into other potential markets."

"Here are producers using biomass from their own farm to produce energy for another part of the operation," Doering says. "This is a true example of producer-owned energy." ■



The Kreidermacher's farm includes a 65,000-square-foot greenhouse where poinsettias, vegetables, bedding plants and perennials grow year-round.