



# AG INNOVATION NEWS<sup>®</sup>

The newspaper of the Agricultural Utilization Research Institute

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# The INNOVATORS

**Despite challenging times, AURI helps businesses create products and jobs**

BY DAN LEMKE

Innovation cannot happen without implementation. AURI's applied research focus helps drive innovation by moving ideas to reality.

AURI scientists, laboratories and project staff support entrepreneurship, enterprise development and local ownership in rural communities — all key to economic recovery.

Unfortunately, during challenging economic times, small to mid-size businesses struggle to invest in research and development. That's why AURI is helping ag-based businesses continue to innovate and build enterprises while creating and retaining jobs.

Following are recent examples of ways that AURI services, staff and mission are working to foster innovations during difficult economic times.

## Product INNOVATIONS

### Klein Foods, Marshall

Klein Foods specializes in manufacturing confections, whipped honey, barbecue sauce and fruit preserves under the Walnut Grove Mercantile label.

AURI technical staff helped the company develop white and dark-chocolate fudge varieties and a fruity barbecue sauce,

assisting with recipe formulation, nutritional analysis and ingredient sourcing. The project resulted in three new jobs, significant production-cost savings and new markets with huge growth potential.

### Eagle Biofuels, Plainview

Eagle Biofuels provides consumers with alternatives to petroleum fuels. The farm-based business packages and delivers corn products and biomass-blended fuels for home heating.

AURI provided technical and laboratory assistance to evaluate energy and ash content of various ag-based pellet fuel blends. AURI also helped connect Eagle Biofuels to other pellet-fuel manufacturers and distributors in the state.

### BitterSweet Bakery, Eagan

AURI assisted BitterSweet Bakery with developing gluten-free products for consumers with gluten intolerance or celiac disease. The bakery's line includes bars, breads, pizzas, cakes, muffins and other gluten-free products.

AURI assisted with nutritional and sensory analysis and helped the bakery establish quality-control systems. The business has created 10 jobs.



BitterSweet Bakery in Eagan, makes gluten-free treats for people with celiac disease, a gluten intolerance.

### Turkey Valley Farms, Marshall

Turkey Valley Farms processes more than 100 million pounds of Minnesota-grown turkeys a year in its 110,000 square-foot facility. The company markets about 50 products, including fresh and frozen whole birds, bone-in and de-boned breasts and thighs, and tray-pack products. Turkey Valley Farm has more than \$60 million in annual sales and about 300 employees.

AURI assisted with product development, including product testing and sensory analysis at the AURI animal products laboratory in Marshall.

## Process INNOVATION

### Biomass densification

As demand for renewable energy grows, so does the need for densified biomass. Cellulosic ethanol, gasification, biomass co-firing and pellet fuels require collecting, handling and storing agricultural biomass. Densification can help overcome one of the largest obstacles to using biomass.

An AURI densification study, shared with Sunrise Agra Fuel, Prairie Agra Fuels, American Ag Energy and others, helped three Minnesota pellet-fuel manufacturers launch their operations and create jobs. The study also helped one company, considering a start up during economic downturn, to mitigate risk.

### North American Fertilizer, Olivia

North American Fertilizer sources and applies biomass-based ash as fertilizer for crop production. AURI technical and pilot lab assistance helped the company densify ash by developing pelleted blends that are easier to handle, transport and use. The project maintained jobs as well as created new jobs in transportation and fertilizer application.

### Microwave drying

AURI has identified a microwave drying technology that could significantly cut costs for agricultural processors. AURI staff have shared information with several companies that could benefit, and one is analyzing the technology's feasibility at its plant.

## Position INNOVATION

### Alternative cutting and merchandising

In late April, AURI will hold meat cutting and marketing workshops to address changing consumer tastes and ethnic markets. More and more consumers are reaching for locally-produced products to increase their connection with farmers. The training will help hundreds of independent meat processors identify opportunities to market specialty meat products to Latino and calorie-conscious consumers. (see story, page 10)

### Alternative feed ingredients

Minnesota's livestock industry has faced challenging economic conditions in recent years, as input costs have risen more rapidly than animal or milk prices. AURI is identifying alternative feed ingredients that may reduce producer costs or increase animal performance. Most of the ingredients being tested are ag-processing leftovers or commodity ingredients processed in a novel way, such as:

**Glycerol.** A biodiesel manufacturing coproduct, glycerol is being tested in dairy calf and turkey diets. Glycerol could potentially replace up to 6 percent of corn in pre- and post-weaned dairy heifers. (see story, page 3)

**Low-oligosaccharide soybean meal.** Low-O meal is being evaluated as an ingredient in baby pig and turkey diets. Initial results show significant improvement over regular soymeal in average daily gain because of improved digestibility.

**High-bypass protein soybean meal.** This specialty meal is processed so protein is better absorbed by dairy cattle, which increases milk production. Benchmark Ag of Cannon Falls is considering plans to construct a production facility and market the specialized meal to dairies in southeast Minnesota and parts of Wisconsin. ■

# SWEET FEED

Glycerin, a biodiesel byproduct, may replace some corn in calf diets



BY DAN LEMKE

*Waseca, Minn.* — Glycerin, a thick, syrupy byproduct of biodiesel production, may sweeten dairy operations. AURI-sponsored feeding trials at the University of Minnesota Southern Research and Outreach Center show glycerin could potentially replace some of the corn in dairy calf diets.

Fluctuating costs in livestock operations affect profits. When grain, protein or mineral costs rise, the profit margins narrow. When they fall, the bottom line improves. Using a low-value ag processing leftover could add stability to costs and benefit both livestock and biodiesel producers.

In 2009, of the 85 million gallons of glycerin produced in the United States, about half was a biodiesel byproduct. Glycerol has already shown potential in tests as a feed ingredient for poultry, cattle and swine.

"We wanted to identify if glycerol could be used as a one-to-one substitute for corn and if it could be utilized as an additional feed ingredient in a least-cost formulation," says scientist Alan Doering who leads AURI's coproduct program in Waseca.

The trials' first stage involved feeding 100 two-to four-day old dairy heifer calves for 56 days. The control group was fed a diet of pelleted or standard texturized feed. The test groups were fed pelleted rations with either three or six percent of the corn replaced by glycerin. Calf diets were supplemented with milk replacer until weaning at 42 days.

"The diets containing three percent glycerol did as well as the control," says Hugh Chester-Jones, dairy animal scientist at the Southern Research and Outreach Center. "The pre-wean gain was about 1.34 pounds per day. Calves on the six percent ration gained about 1.26 pounds a day, so they did nearly as well."

In the trials' second phase, calves 63 to 70 days old were fed either a control diet or three or six percent glycerin diets for 84 days. The calves weighed about 180 pounds at the start and finished the tests at around 450 pounds. As with the younger calves, the glycerin-enriched diets yielded no ill effects on growth.

"Our study showed that glycerin could be fed as high as six percent without sacrificing any performance," says research center scientist David Ziegler.

"Producers are primarily concerned with feed efficiency and average daily gain," Doering says. "These trials show that glycerin could offer an opportunity for dairy producers. It all depends on the economics."

One Minnesota company is marketing feed-grade glycerin at 14 cents per pound. Calculating energy values, Doering says 14 cent per pound glycerin is comparable to \$3.08 per bushel corn.

"Corn is still going to provide the majority of the energy in a dairy diet," Doering says. "But there may be times including a percentage of glycerin can help lower those feed costs." ■



In an AURI-sponsored trial, calves fed pellets with three-percent glycerin, a corn replacement, did as well as those fed a traditional diet. On the cover: Al Doering (left), AURI scientist, and David Ziegler, Southern Research and Outreach Center scientist, conducted the feeding trials on glycerin, a biodiesel byproduct.

# AGRIpreneurs

Rural Enterprise Center designs poultry production model for southeast Minnesota Latino community

**“If we’re going to do something to support families living in poverty, it can’t cost a lot of money.”**

By Cindy Green

*Northfield, Minn.* — It starts with a chicken. It ends with an enterprise.

It’s Regi Haslett-Marroquin’s vision to help Latino farmers in southeast Minnesota become “agripreneurs” — self-sufficient members of the community. As director of the Rural Enterprise Center in Northfield, he has been training immigrants to manage small chicken flocks. They collectively market the poultry as members of the Hillside Farmer’s Co-op.

Eventually, Haslett-Marroquin wants the cooperative’s network to include processing, distribution, marketing and value-

added product development — not only for poultry but vegetables and legumes grown with rich, chicken-manure fertilizer.

“If we’re going to do something to support families living in poverty, it can’t cost a lot of money,” says Haslett-Marroquin, an agronomist and former United Nations development consultant. Because a chicken can be raised from hatch to market weight in six to eight weeks, a farmer can turn a profit in a relatively short time, without much capital investment.

In Latin American countries, families often raise their own chickens, so poultry farming on a small scale is familiar to the Latino community. Farmer immigrants often work in poultry processing plants and other ag-related industries as well as on farms. Yet few have the financial resources to start their own business or buy farmland.

The Rural Enterprise Center has designed an “Agripreneur Training Model,” with the goal to help Latino families “break the cycle of poverty, so they can participate in and contribute to the long-term vitality of their communities.”

“Regi has designed a system with relatively low up-front costs. That’s a unique component,” says Kate Paris, AURI project director. “The Rural Enterprise Center has been methodical about how they are building their enterprise and how they are getting their community engaged.”

## Bird beginnings

“Poultry is the easiest and most affordable way to get into agriculture,” Haslett-Marroquin says. The model’s first phase is to engage Latino farmers in raising free-range chickens on quarter-acre parcels. Haslett-Marroquin, who owns a 40-acre farm near Northfield, and a Cannon Falls farmer are contributing parcels for the initiative.

Seven Latino farmers are currently raising chickens on the farm plots and 12 have been trained in on-site poultry processing. Poultry is sold direct from Hilltop co-op farms and through Community Supported Agriculture groups, which deliver farm-fresh produce to CSA members.

“We’ll have our own label by the end of this summer and we’ll have products for next fall,” that will be distributed to food co-ops and other retailers, says Haslett-Marroquin, who is experienced in enterprise building. A few years after moving to the United States from Guatemala in 1992, he co-founded Peace Coffee, a subsidiary of the Institute for Agriculture and Trade Policy that markets fair-trade coffee from around the world. In 1996, he was named one of the Twin Cities International Citizens of the Year.

## Taste tests and experimental houses

The Hillside Farmer’s Co-op serves customers who want poultry raised without antibiotics so they are testing several natural medicinals at AURI’s meat lab in Marshall.

Chemists conducted analytical tests on the poultry and led taste panels to see if alternative diets affect the meat’s composition, texture or flavor.

“There wasn’t a whole lot of difference,” between free-range chicken fed traditional or alternative diets, says Carissa Nath, AURI meat lab technologist. “That is what we were hoping for. The only difference Regi wants is for the birds health.”

Haslett-Marroquin is also experimenting with housing to raise chickens year-round in a free-range environment. Last summer, he built an insulated hoop house that is heated with solar panels rather than fuel or electricity. “The building has not dropped below 20 degrees,” he says.

## Building a network

Last summer, after raising poultry for two years, the Hillside Farmers Co-op had accumulated enough composted chicken manure for community gardens managed by about 40 Latino farmers. “We planted four acres of black beans to grow seeds for next year’s planting,” he says.

They also planted hazelnut trees, which will produce edible nuts in about four years. “None of these are quick fixes. We’re establishing a long-term system.” Eventually, small-scale operations, from vegetable to poultry producers, will join into a single network marketed under one label.

After the co-op has an established network of producers, “then you have processing needs ... then financing, trucking, freezing.”

“We are setting up a network of cooperatives — each co-op is a network of farms. The overall co-op is an economic cluster,” which will share a brand label, Regi says. “When you take a bunch of related enterprises and you put them together, it has a multiplier effect in the local economy.”

“So much of what Regi’s trying to do is so in line with AURI’s mission — building capacity for producers to own more of the value chain,” Paris says. “He’s building off the strength of the community he’s working with to add value to their product.”

“As we do this, we don’t want to be just growers, we want to be business people,” Haslett-Marroquin says. “We want to build a resilient system. That doesn’t get built in a year or two.

“We’re putting the footings up.” ■

Regi Haslett-Marroquin is director of the Rural Enterprise Center in Northfield, which is training Latino community members to raise free-range poultry on quarter-acre farm parcels. Eventually the Center wants to build a network of poultry and vegetable farmers, processors and distributors who market under one label.



# COPRODUCTS PROGRAMS FINDS

# GOLD IN WASTE

BY ALAN DOERING

Something old can be made new again. At AURI's coproducts lab in Waseca, we take what once was called waste — vegetable peels, corn stalks, animal manure, ash, other leftovers — and help entrepreneurial businesses turn it into mulch, pelleted fuel, hog mats and a myriad of other value-added products.

The mission of AURI's Coproducts Utilization Program is to develop new uses for ag processing leftovers, plant and animal coproducts and agricultural biomass that present environmental and economic opportunities. Coproducts are used in fertilizers, sorbents, renewable fuels, animal feeds, soil amendments and biodegradable products.

There are several opportunities that will receive considerable research and development attention in the months ahead.

## Enhanced anaerobic digestion

Anaerobic digestion is not new, but its potential is just being scratched. While digesters are primarily fed by livestock manure, more and more communities are considering ag processing waste. Besides their energy value, using waste from local facilities could help solve waste handling issues. As we learn more about how various feedstocks react in a digester, "recipes" will be developed to maximize gas production. Also, there will be increased efforts to clean up biogas so it is pipeline quality.

## Bio-based products

Among ag-coproducts' emerging uses are identifying lower-cost energy and protein sources for livestock feed. As producers reduce costs, ag-processing leftovers such as glycerin, solubles and other materials may take the place of traditional ingredients. There are also opportunities to develop fibers and chemical extractions from ag residues.

As the price of fertilizer climbs, natural fertilizers are likely to gain momentum. Using processing leftovers such as ethanol solubles, ash and other products may be a reasonable alternative. That also requires identifying and developing technologies for handling biomass-derived ash and biochar for fertilizer and soil amendments. In the future, carbon may be sequestered using agricultural coproducts and practices.

## Solid biomass fuel production

Using crop residues, specialty energy crops or processing leftovers as solid-fuel sources continues to be an active coproduct utilization focus. Scientists are developing densified fuels, such as pellets or briquettes, for gasification systems, direct combustion or for co-firing to produce heat or steam. Key factors for developing biomass fuel include biomass harvesting, densification technology, ash content, chlorides and economics.

## Biomass fuel equipment improvements

Many of today's combustion systems were not designed to run on agricultural biomass. Technology improvements, including feedstock handling, burn pot performance and overall efficiency, will play a role in the long-term viability and development of solid biofuels.

## Drying and densification improvements

Among the biggest challenges of using coproducts, particularly biomass, is handling. Most ag residues are light, bulky and wet. New drying technologies and small, portable densification technologies could make biomass handling more efficient. As with most technologies, economics is key to their success. ■

## Staff profile: Alan Doering

AURI associate scientist for coproducts



### What is your education background?

I'm a graduate of South Dakota State University in Brookings, with a degree in Agricultural Extension and Animal Science.

### What do you do at AURI?

After 10 years, I still struggle answering that question. The problem isn't explaining my day-to-day role; rather it's trying to describe the wide range of activities and projects before the person who asked the question runs out of time.

Actually, I identify project areas for the coproducts program, assist in the day-to-day operation of the lab, and work with clients to develop and test new feed, fiber or fuel products from ag coproducts. Everything we do is to impact producers, processors or entrepreneurs. I also spend a lot of time on the phone as a resource for industry. Since we collect unique data, there is great deal of interest in what we know.

### What are some of your most unusual lab experiments?

I've made synthetic cat urine for litter testing, processed fibers for natural food coloring that left my skin blue for a day, worked with biochar and created dust, so associate scientist Kevin Hennessy and I walked out of the lab looking like coal miners.



PHOTOS BY ROLF HAGBERG

# GREEN WORKS

## AURI report explores 'green' job creation in Minnesota agriculture

Demand for local specialty products, such as artisan cheeses, wine, beer and organic poultry and meat could add processing jobs in rural Minnesota. New retail merchandising techniques will let shoppers trace food products all the way back to the farm and even compare the sustainability of competing products.

Unfortunately, the livestock industry has not "done a good job of telling our story," says State Representative Rod Hamilton, a Mountain Lake, Minn. farmer. "We are often combating fallacies ... Everyone involved needs to help educate people."

### Assuring safety

Food safety is another major trend that will spur green ag jobs, Paris says. "Consumer concerns about food health and safety are shaping the industry at every level," the report says. "Consumers and regulators alike are sharpening focus on how food is grown, processed and produced."

### Brain drain

There are other threats to green-job growth in agriculture.

One of the most vexing is the "rural brain drain," Russell says. When educated, talented young people leave small farming communities, they take with them the skills and energy that propel innovation, entrepreneurship and prosperity, she says.

This will expand the need for jobs and businesses that ensure a safe food supply. For example: companies to track food through the supply chain, technologies to measure food freshness or contamination, hazard analysis experts, food-safety inspectors and trainers, regulatory compliance officers, quality control specialists.

Other threats to green-job expansion include weakened demand for food and commodities, volatile crop and energy prices, red ink in the livestock sector, and burdensome or patchwork regulation, the report says. Food sector start-ups and small businesses are stymied by limited access to capital and land, the high price of health and liability insurance, and steep costs for certification and food safety compliance.

Food-safety jobs will also emerge in high-tech fields such as bioinformation systems, genomics, systems biology and nanotechnology, says Amy Johnson of BioBusiness Alliance of Minnesota. These fields "may not seem to be related to the food industry," she says, "but they truly are." She sees "tremendous potential for those businesses to be created within Minnesota," a technology leader. "There is a definite concentration of skill sets here."

### Job refocus

Still, there are many steps that can be taken to help Minnesota agriculture respond to emerging green trends, the report says.

Foremost is education — training a workforce to meet the needs of the green economy, Juhnke says. Educators and professionals will be needed in food science, plant genetics, biofuel production, waste utilization, ag software development and business management, to name just a few of the fields that will see green-job growth.

It's important to recognize that the green economy may not produce a significant net increase in Minnesota ag jobs, Russell says. "It may be more about job refocusing" — not more jobs, but different jobs.

The long-term trend in both production agriculture and processing is more output with less labor, the report notes. Employment on Minnesota farms is expected to be flat through 2016, while employment in Minnesota's dairy, produce and beverage processing sectors is predicted to decline. Meat and poultry processing employment is expected to increase about 4 percent.

In production agriculture, the green economy will likely prompt a shift to more support jobs, such as agronomy, engineering and precision agriculture services, the report says. In food processing, there could be a shift from manufacturing to jobs in research and development, biotechnology, waste recycling and energy conservation. Almost half of the top 50 U.S. food processors, for example, have sustainability initiatives, such as lowering greenhouse gas emissions and using more renewable energy.

Today, agriculture and food production accounts for one-fifth of Minnesota's economic activity and generates more than 350,000 jobs. "Our state is very strong in agriculture and it's easy to take it for granted," Paris says. Agriculture is "part of what drives the economic health of our state," she says. "We can use it as a launching pad for further growth."

"It's important we grow awareness for this industry," Juhnke says. "It's more than just growing and processing — agriculture is economic development."

To read the report, go to [www.auri.org](http://www.auri.org)

By Liz Morrison

A plucky little start-up company in Afton, Minn. is manufacturing natural red food dye, extracted from a new variety of purple corn grown in southwest Minnesota.

Suntava is selling its trademarked Sayela colorant to food and beverage makers. Sayela is derived from Suntava Purple Corn, a hybrid developed by Red Rock Genetics, an independent corn genetics company in Lamberton, Minn. The high-value niche crop is raised by farmer-members of Meadowland Cooperative in Lamberton.

Suntava and its collaborators exemplify "green industry" trends — crop diversity, health-promoting foods, high-tech research, product development — that will propel job growth in Minnesota agriculture in the coming decades.

Green trends are explored in a new AURI report, "Minnesota Food Production Sector: Growing Green Jobs," prepared at the request of the Minnesota Legislature. The study looks at green-job opportunities in Minnesota's diverse food industry, says Teresa Spaeth, AURI executive director. It lays out some of the challenges to job creation and suggests ways that "Minnesota can support high-quality job growth and entrepreneurship in the food production sector," Spaeth says.

Green jobs are usually associated with renewable energy, says Minnesota State Representative Al Juhnke of Willmar, agriculture finance committee chair and an AURI board member. Yet, "agriculture is the original green industry. There's a lot of opportunity in agriculture for value-added green job growth. And a good number of these jobs could be in rural Minnesota."

### Market drives growth

Consumers are driving green-job growth in Minnesota agriculture, says AURI project director Kate Paris, who led the report's research team.

"Sustainability is clearly not a fad," the report says, but "will, in fact, change food production at every stage of the supply chain — including on the farm."

At the farm level, demand will rise for a greater variety of local and "naturally-grown" products, says report author Carol Russell of Russell Herder, a Minnesota market research firm. That could lead to more jobs for certified organic producers and truck farmers who serve nearby urban markets. Sustainable agriculture educators, organic certification consultants, horticultural experts and other production support jobs could follow.

Local and regional food distributors will be needed to gather and sell locally-grown foods to wholesale and food service outlets. Farmers markets, on-farm stores and local marketing cooperatives could generate new direct-marketing jobs, too.

### Innovation

Food processing innovations will also generate green jobs, Carol Russell says. A good example is the rising popularity of "functional foods," which offer health benefits. Minnesota could become a leader in this sector, "thanks to its powerful combination of research capability, food-processing prowess and production diversity," she says.

Large Minnesota food processors such as Hormel, General Mills and Land O' Lakes — and their suppliers — are all pouring resources into functional food research and development, says AURI food scientist Charan Wadhawan. The same is true of small Minnesota companies such as Suntava, which is developing natural food color. Food science advances will also offer opportunities for Minnesota farmers to grow specialty crops, like red corn, for pharmaceutical or functional food uses, Russell says.

### Animal agriculture at risk?

Amidst all this potential job growth, one of Minnesota agriculture's most important job sources may be at risk, Paris says.

Livestock production and processing, which generates more than 100,000 jobs and contributes \$11 billion to Minnesota's economy, faces "significant external threats," the report says. Increased regulation, public fears about manure management and animal welfare, and local land use conflicts could all weigh on Minnesota's livestock sector. "Misunderstandings about animal agriculture could have a dramatic impact on not only livestock production in the state, but also the grain producers and food processors that rely on this agricultural sector," the report says.

Yet animal agriculture offers one of Minnesota's best opportunities for job growth and economic development, says Kevin Paap, Minnesota Farm Bureau president. "A 400-head dairy generates more jobs than a 4,000-acre crop farm. It also has an impact on grain farmers for feed demand, veterinary services and other enterprises throughout the community, which creates even greater job growth."



## Minnesota farmers surveyed

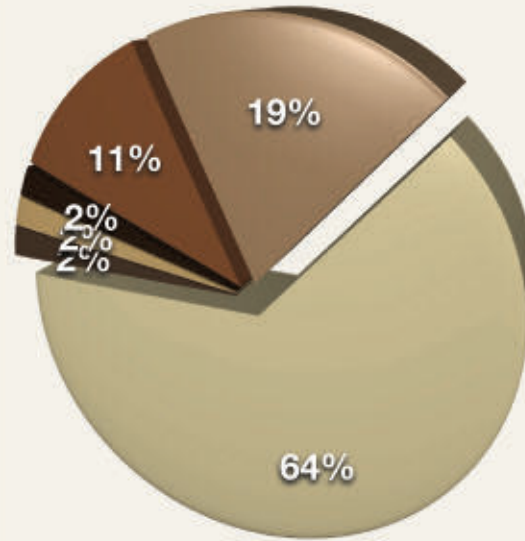
As part of the "Growing Green Jobs" report to the Minnesota Legislature, AURI surveyed Minnesota farmers.

Nearly two-thirds said that "consumers are driving change in agriculture and food production."

Farmers said the greatest opportunities for agricultural job growth are in renewable energy, locally-grown food enterprises, community-supported agriculture, specialty crops for specific health or industrial uses and agri-tourism.

Among farmers' top concerns were:

- Health care costs
- Preserving family farms
- Energy costs
- Educating consumers about agriculture and food production
- Price fluctuations



## Minnesota Agriculture Employment

- Ag wholesale and retail trade
- Farm production
- Ag processing and marketing
- Ag input industries
- Indirect agribusiness
- Ag services

## Agriculture: cornerstone of the Minnesota economy

- ❑ Agriculture production and processing generates one-fifth of Minnesota's economic activity.
- ❑ Every agricultural production job supports an additional 1.5 jobs in all economic sectors, including manufacturing, wholesale and retail trade, services, transportation, construction, banking, insurance and real estate.
- ❑ Minnesota agriculture generates 367,000 jobs, making it the state's second-largest employment sector.
- ❑ Employment in agriculture and food production accounts for 15 percent of Minnesota jobs.
- ❑ In rural Minnesota, agricultural employment accounts for one-third of all jobs.
- ❑ Even in metro areas, agricultural employment accounts for 13 percent of all jobs.
- ❑ More than 80 percent of all agricultural jobs are off-farm — in processing, distribution, supply and service. Less than 100,000 are on-farm jobs.

Sources: Minnesota Department of Agriculture, "Agriculture — The Foundation of Minnesota's Economy," 2010; "Minnesota Food Production Sector: Growing Green Jobs," 2010.

## Growing green ag jobs: what will it take?

- Greater awareness of the business and career opportunities in agriculture and food production
- Investments in research and development of new value-added food products
- Education and business development programs for farmers and food processors
- Access to food distribution channels for small farms
- A robust animal agriculture sector
- Streamlined regulation

Source: "Minnesota Food Production Sector: Growing Green Jobs, 2010"

## Green ag careers

- Agricultural economists
- Agricultural educators
- Agricultural engineers
- Agricultural software developers
- Agronomists
- Artisan cheese makers
- Bacteriologists
- Boiler operators, mechanics, electricians to sustain high-tech food processing
- Biomass businesses
- Biotechnology
- Business entrepreneurs
- Community-supported agriculture coordinators
- Culinologists
- Energy-crop production
- Food-handling specialists
- Food marketers
- Food processors
- Food-safety experts and compliance inspectors
- Food scientists
- Green product research and development
- Identity-preserved crop specialists
- Livestock nutritionists
- Livestock scientists and geneticists
- Local farm-product purchasing, aggregation and distribution agents
- Meat scientists
- Nutritionists
- Organic farmers
- Organic processors
- Plant geneticists
- Precision agriculture specialists
- Quality control specialists
- Regulatory compliance experts
- Soil and water specialists
- Solid waste engineering and management
- Supply chain and procurement
- Sustainability consultants
- Sustainable landscape designers
- Truck farmers
- Urban gardening and horticulture experts
- Waste recycling and anaerobic digestion

# Char-crossed fuel

Biochar from biomass gasification could substitute for coal if made easier to handle

By Liz Morrison

The challenge with biochar is holding it all together.

The fine, black soot-like material is a byproduct of biomass gasification. Biochar could be used as a coal substitute if it could be compacted into granules or pellets for easy handling. AURI is working with the Chippewa Valley Ethanol Company (CVEC) in Benson to solve this problem.

CVEC, a 48-million-gallon corn dry mill, operates Minnesota's only commercial biomass gasifier. The flexible-fuel reactor is powered by wood, corn cobs and glycerin and will eventually supply most of the plant's energy.

Biochar is produced when organic materials are heated with limited oxygen, a thermochemical reaction called pyrolysis. The process yields renewable biogas — a natural gas substitute, which CVEC uses to run the ethanol plant — and biomass charcoal or "biochar." When CVEC's gasifier is operating at full capacity, it will generate about 5,000 tons a year of biochar.

Half carbon, biochar has the consistency of talcum powder. "It's hard to handle," says AURI scientist Al Doering. Compacting the material into solid granules or pellets would greatly improve handling ease and safety, he says. Granulated biochar could be blended with other products, moved with standard equipment, and shipped more economically.

But as it turns out, compacting biochar is not easy. Unlike combustion ashes, biochar isn't the least bit adhesive.

Previous efforts to "densify" the material have failed, Doering says. Yet cost-effective biochar handling is essential for advancing Minnesota's gasification industry. "We're going to see a lot more of this material coming onto the market as gasification develops in the state."

One idea AURI is working on is blending biochar with low-value agricultural fibers, which readily form durable pellets. Fiber candidates include sugar beet processing waste, wood and ground corn stover or other crop residues. Doering is leading processing trials at AURI's coproducts lab in Waseca.

Meanwhile, Bepex International, a Minneapolis food and materials handling company, is looking at compacting biochar into larger briquettes. "We'll see what is least costly and most effective," Doering says.

## Green fuel from black char

Solving the handling problem would open up several new uses for biochar: as a soil amendment for weathered, low-organic-matter soils; as a tool to lock carbon in the soil, reducing greenhouse gases; as a renewable fuel.

Using biochar as a renewable fuel is the most promising opportunity at the moment, Doering says, although that could change if Congress funds carbon credits, which would pay for practices that sequester carbon.

CVEC biochar has an energy value of about 7,000 BTUs per pound, says Vincent Copa, the plant's process engineer. That's just a little less than wood or sub-bituminous coal. And it does not have impurities, such as sulfur and mercury, that produce harmful emissions, Copa says.

PHOTOS BY ROLF HAGBERG







If biochar can be economically pelleted, it could be co-fired with coal, Copa says. CVEC is exploring this possibility with the nearby 17-megawatt Willmar municipal power plant. "Biochar could replace some coal and could also improve emissions," he says. Willmar Municipal Utilities has already put up two wind turbines and is pursuing other forms of renewable power, such as co-firing corn cobs.

CVEC now pays about \$75 per ton to dispose of its biochar in a landfill. Successful densification could save disposal costs and keep a useful product from being wasted, Copa says. "This is important to Minnesota as we develop sustainable green-power systems." ■



AURI scientist Al Doering experiments with biochar, a fine soot-like byproduct of biomass gasification, which could be co-fired with coal if it's compacted for easier handling. Pictured above are samples of biochar, on right, and granulated ash products.



PHOTO BY ROLF HAGBERG

## 'U' trials test biochar's fertilizer value

Fertile Minnesota soils don't benefit, but carbon sequestration shows promise

By Liz Morrison

Thousands of years ago, the Indians of the Amazon River Basin improved their unproductive tropical soils by mixing in charcoal made from smoldering wood. Ancient terra preta — or "black soil" in Portuguese — remains fertile today, rich in nutrients and organic matter.

Could biochar, which is similar to charcoal, provide a fertility boost for crops grown in Minnesota soils? That question prompted recent AURI-sponsored research by the University of Minnesota.

As Minnesota's biofuel industry expands, there will be a growing supply of biomass ashes, including biochar, a fine-grained charcoal high in carbon and potassium, says AURI coproducts scientist Al Doering. "Utilizing these coproducts is critical to the future success, profitability and sustainability of the biofuel industry."

In 2008, soil scientist Jeffrey Vetsch of the U of M Southern Research and Outreach Center, tested three types of biofuel ashes as corn fertilizer in replicated trials at Waseca. The ash sources included combusted turkey manure, combusted distillers solubles, and biochar from gasified wood and corn cobs.

Both combustion ashes proved to be good sources of plant-available phosphorus and potassium and produced corn yields comparable to commercial fertilizer, Vetsch found. However, "no measurable agronomic benefit to the char ash was found in this study."

There could be several reasons for that, Vetsch says. Biochar resists decomposition by soil microbes, so the nutrients in the ash are not readily available to plants. On Minnesota's highly-productive clay loam and glacial till soils, where

organic matter levels typically reach 3, 4, 5, even 6 percent, biochar "may actually immobilize essential nutrients, especially nitrogen and phosphorus," Vetsch says.

By contrast, biochar benefits "have been found on highly-weathered, low-organic-matter soils," he says, where biochar may raise fertility, boost long-term organic matter content and prevent nutrient leaching.

Biochar might have agronomic benefits on certain sandy soils in Minnesota. But Vetsch says it is probably best suited to severely depleted, acidic soils with little humus, "which we don't have in Minnesota. The closest place in the U.S. with those soils is the mid South."

### Carbon 'sink' potential

Biochar's greater potential in Minnesota is for storing carbon in the soil, Vetsch says.

In fact, biochar is attracting interest these days as a tool to combat climate change, Doering says. "It's one of the best ways to capture and sequester carbon." Through plant photosynthesis and pyrolysis, carbon dioxide — a potent greenhouse gas — could be removed from the atmosphere and stored in the ground as solid carbon. And because biochar doesn't easily decompose, carbon could be safely locked up for decades, he adds.

Injecting biochar into the soil could make biofuel production carbon neutral or even carbon negative, Doering says. But that depends on policies or economic incentives, such as carbon credits, that "would put a value on carbon sequestration," he says. "If there is ever a value put on carbon sequestration, this use would be a big one." ■

# Elsewhere in ag innovations

BY DAN LEMKE  
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. Please note that ARS is the USDA's research division.*



## Dairy wrap

Dairy products may perform as well or better than petroleum in food packaging. USDA-ARS researchers are developing strong, biodegradable, dairy-based films that provide excellent oxygen barriers. Most food packaging consists of multiple layers of synthetic polymers. But consumers and food retailers are increasingly concerned about packaging waste.

Films made from dairy proteins such as casein and whey show promise and provide a better oxygen barrier than their petrochemical counterparts. Researchers are working to improve the renewable films' mechanical and barrier properties for various applications.

From: USDA-ARS  
January 20, 2010

## Tobacco fuel

Once a key agricultural crop in southern states and now reviled by many, the tobacco plant may improve its popularity in renewable fuels. Most of a tobacco plant's oil is in its seeds. That oil has been tested as a diesel-engine fuel. Thomas Jefferson University researchers say they have found ways to engineer tobacco plants so the leaves express more oil, up to a twenty-fold increase, which would make the high-biomass plant a more attractive fuel feedstock.

From: Thomas Jefferson University  
January 5, 2010

## Comfortable soy seats

Travelers visiting some of the world's largest and busiest airports may rest their weary bones on beans. Arconas, a global leader in airport seating, has started installing seats made with Cargill's soy-based polyols. Soy foam is already widely used in residential furniture, but is just being introduced in airports such as Dallas/Fort Worth, Boston's Logan and Lisbon International Airport.

From: Biobasednews.com  
November 30, 2009



## Soy introductions

2009 was a big year for new soy-based products. The United Soybean Board helped introduce 26 products made with U.S. soybeans, such as insulation foams, furniture, automotive seating, adhesives, coatings, inks, cleaners, degreasers and adhesive removers. USB partners with industry and scientists to fund the research, development and commercialization of new products

Consumers can easily find some of the new products, including a soy-based wood floor stain from Rust-Oleum, a line of Simmons mattresses that include soy-based foam, and a degreaser and adhesive remover available at Home Depot and Ace Hardware. Other soy-based products, such as a plywood adhesive, pavement crack sealant and bioremediation agents used in environmental cleanup, are primarily for industrial uses.

From: Biobased Solutions  
January 2010

## Soy fighters

A study by the Children's Hospital & Research Center in Oakland, Calif. has identified therapeutic agents in soy that may prevent or treat colon cancer. Tests on fruit flies showed that sphingadienes — natural lipid molecules found in soy — induced the death of mutant cells in flies. Cell death is a normal process the body uses to remove unhealthy or mutant cells such as cancer cells.

From: Cancer Research  
December 15, 2009

## Tired biomass

Soon our vehicles may not only be powered by biofuels but ride on tires made with renewable biomass. Genencor and Goodyear have rolled out concept tires made with Biolsoprene. The technology replaces a petrochemical-based ingredient with one derived from biomass.

The tires have been on display around the world, including the United Nations Climate Change Conference in Copenhagen, Denmark. Genencor researchers say Biolsoprene may also be used in other rubber products and adhesives.

From: Biobasednews.com  
December 2, 2009



# AURI TO HOLD SPECIALTY MEAT-CUT TRAINING

## Workshops will help meat cutters and retailers reach Latino and diet-conscious markets

BY DAN LEMKE

### Cuts for calorie counters

Attend one of two sessions:

Thursday April 29, 10 a.m. to 12:30 p.m.

Friday April 30, 10 a.m. to 12:30 p.m.

Consumers who want to lose a few pounds are looking for leaner cuts at the meat counter. They aren't always finding what they want.

"Cattle market weights have gotten heavier over the years, so some of the cuts offered come in larger portions than many consumers want," says Carissa Nath, AURI meat technologist. "Some meat cutters and retailers have simply cut the pieces thinner to reduce portion size, but that can affect the quality of the eating experience."

The one-day workshops will provide information about alternative cutting techniques that result in smaller portion sizes without compromising quality. "If Minnesota processors are able to produce more of the products consumers want, it should increase their marketing opportunities," Nath says. Besides retail benefits, "it should mean increased demand for the livestock producers."

Marshall, Minn. — As populations change and grow, so do market demands. New meat cuts could help Minnesota beef and pork industries market to Latino populations and weight-conscious consumers.

The Agricultural Utilization Research Institute and Minnesota's Beef Council and Pork Board are holding one-day training sessions in late April to give Minnesota meat processors and retailers an edge. Both workshops will be held at the AURI meat lab in the Science and Technology building at Southwest State University in Marshall.

### Cuts for Latino markets

Attend one of two sessions:

Thursday April 29, 1 to 4 p.m.

Friday, April 30, 1 to 4 p.m.

The Latino community is the largest ethnic minority in Minnesota, comprising more than 4 percent of state's population, according to the U.S. Census Bureau. "We've been hearing from processors and retailers that Latino consumers are coming in looking for different cuts than what they currently offer," says Carissa Nath, AURI meat technologist. Faced with steady or slumping demand, Nath says many processors "are eager to service that population."

Consumer research shows many Latino consumers prefer beef and pork cuts that are suitable for making stews as well as thinner cuts for quicker cooking. Processors and retailers will receive technical training on cutting techniques. They will also learn how to market to Latino consumers with sessions on trends, shopping habits and consumer preferences.

For more information or to register for the workshops, contact the AURI Southwest Office at (507) 537-7440; or email Carissa Nath at [cnath@auri.org](mailto:cnath@auri.org)

# No time to wait

BY TERESA SPAETH

While it is said that good things come to those who wait, often those who push the envelope benefit most. Minnesota has a rich history of envelope-pushers, with the likes of 3M, General Mills and Best Buy. Industry leaders recognize they have to be on the front line of developing products that meet consumer demands.

AURI has a 20-year track record of implementing agricultural innovations. From ag-based biofuels and industrial products to value-added uses for ag-processing leftovers, AURI has provided scientific and technical assistance, industry-wide research initiatives and targeted networking to move ideas to implementation.

Now we plan to take the next step and actively pursue innovation. AURI proposes to create a New Generation Innovation Center to jump-start local economies by generating, selecting and implementing rural innovations. The Center will actively bring together communities

of innovation, such as researchers, businesses, economic development specialists, bankers and others, and capitalize on their collective intelligence.

The New Generation Innovation Center concept will be used to develop communities of innovation in bioenergy, bio-based products, coproducts and food production. These categories offer the most promise for novel ventures in rural communities where there is an abundance of raw materials, processors, knowledge base and other assets. Communities of innovation will share information and resources to positively impact rural economies.

AURI is proposing this as a way to support homegrown innovation and entrepreneurship in rural areas. Efforts like this are vital to creating jobs and business with rural communities' existing assets.

While good things may come to those who wait, sometimes there is just no time to wait. ■



## AURI GUIDE TO SERVICES

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
  - Product Development Lab, Crookston
  - Fermentation and Chemistry Lab, Crookston

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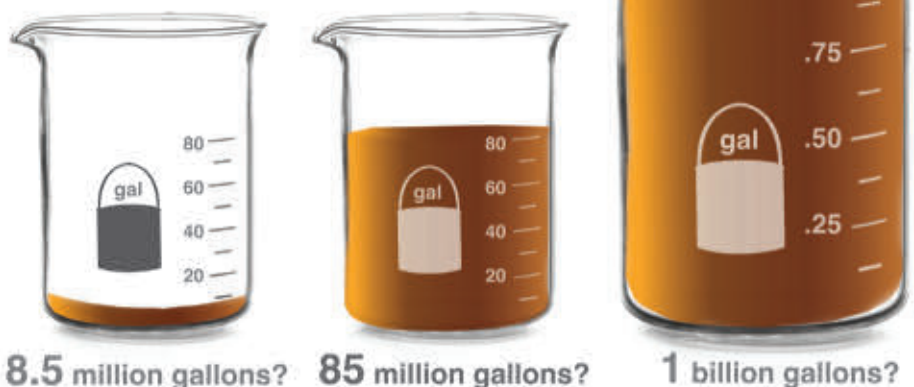
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## AURI ag quiz

- Biochar is produced when heated with limited oxygen in a process called what?
  - Pyromania
  - Pyrotechnics
  - Pyrolysis
- What is one of the most unusual testing items used at AURI's coproducts lab in Waseca?
  - Synthetic cat urine
  - Baseball bat made from wheat
  - Automatic dog polisher
- Approximately how much glycerin is produced in the United States in 2009?
  - 85 million gallons
  - 8.5 million gallons
  - 1 billion gallons
- What model has the Rural Enterprise Center designed to help Latino community members be self-sufficient?
  - Chickens 101
  - Modeling bioplastics
  - Agripreneur training model
- Who is driving the growth in "green jobs"?
  - Government
  - Consumers
  - Researchers
- What west central Minnesota industry sector is interested in using bioplastics?
  - Manufacturers
  - Retailers
  - Food service
- What is the Portuguese term for fertile soil?
  - Terra Cotta
  - Terra Nova
  - Terra Preta
- What automotive product may soon include biomass-based components?
  - Tires
  - Windshields
  - Transmission

## How much glycerin per year?



Answers: 1)c 2)a 3)a 4)c 5)b 6)a 7)c 8)a

## ABOUT AG INNOVATION NEWS

Dan Lemke, communications director  
Cindy Green, managing editor  
Rolf Hagberg, photography  
Design by [pounce.com](http://pounce.com)

Published by the Agricultural Utilization Research Institute to inform the food, agriculture and business communities and the general public about developments in ag-based products.

For information on AURI, call 1-800-279-5010 or visit our Web site: [www.auri.org](http://www.auri.org)

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# Bioproducts in the heartland



Manufacturers in west central Minnesota are looking at the potential for incorporating bio-based plastics and other materials into their products

## West central Minnesota companies consider adding renewable plastics to their manufacturing mix

By Dan Lemke

*Fergus Falls, Minn.* — When business gets tough, creativity is key. Some west central Minnesota manufacturers are hoping they can unlock new markets with bioproducts.

Harold Stanislawski, Fergus Falls Economic Improvement Commission executive director, is spearheading an effort by area manufacturers to produce more bioproducts. Some have excess capacity and are interested in renewable products, he says. One company is considering replacing some of its manufactured components with bioplastics.

Typically made from soybean oil, corn starch or other ag-based renewable sources, bioplastic films, foams and rigid products could offer a 'greener' alternative with good market potential.

"A report from the Bio Business Alliance predicted that the renewable materials market was likely to grow," Stanislawski says. "We looked at our assets to see if we have the capacity to be a player. We've identified several products made in our region that could be manufactured here using bioproducts."

The west central region includes manufacturers of injection and rotational molded parts and sheet fabricators. "If renewable ingredients can meet their specifications, the market could be endless."

AURI and the Minnesota Soybean Growers are sponsoring a market evaluation to determine what manufactured items or components made in the region could be converted to bioproducts and if it would be economical to make the switch.

Some bioproducts may need further scientific development to make sure they meet the same specifications as traditional products. And cost could be a factor. Manufacturers aren't likely to switch to a bioproduct that isn't cost competitive. Results of the market study should be available in early summer.

"A lot of effort in bioproducts began with convincing county governments to buy them," says Michael Sparby, AURI project director. "Getting bioproducts in manufacturing is the next logical step. It could give those manufacturers access to all kinds of new markets." ■