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# **AG INNOVATION NEWS**<sup>®</sup>

*The newspaper of the Agricultural Utilization Research Institute*



**SPECIAL REPORT:**  
*Opportunities in  
value-added  
agriculture*

# SPECIAL REPORT:

## OPPORTUNITIES IN VALUE-ADDED AGRICULTURE

Change may be welcomed or feared. But almost always, it brings opportunity — especially in value-added agriculture.

Brought on by changing global realities, prospects for value-added agriculture are rapidly expanding. In this issue, we have taken a snapshot of what to expect from ag innovators in five major areas: bioproducts, renewable fuels, nutraceuticals and pharmaceuticals, food products, and landscape and garden products.

More than ever, consumers are interested in reducing dependence on foreign oil and developing renewable energy sources. Biofuels are especially popular in Minnesota, home to 15 ethanol plants and the first state in the nation to require that all diesel fuel sold here contain two percent biodiesel. While corn and soybeans are now the main stock of biofuels, everything from

stalks to food processing and animal wastes is being explored. Ag co-products are also showing up in fertilizers and landscape mulches.

Entrepreneurs are designing adhesives, lubricants, building materials and even cosmetics that substitute renewable products for petroleum ones. Roger Ruan, a University of Minnesota scientist, predicts that someday "biorefining will replace petroleum refining."

Market researchers are finding consumers want more control over their health, creating demand for food components to prevent or treat disease. Fructooligosaccharides, lutein, soy isoflavones, omega-3 fatty acids and

conjugated linoleic acid are some of the ingredients touted or added to food products to increase sales. Small companies can also take advantage of the growth in convenience foods, gourmet markets, organic and natural foods, and food safety awareness. Exports continue to grow, especially for private label and food service products.

In all these areas, AURI is helping businesses and agricultural groups design innovative products to benefit our state's economy and help revitalize rural communities. The following pages feature some of the research areas and products AURI supports.



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### EXECUTIVE DIRECTOR'S COLUMN

## A game plan for agriculture

BY EDGAR OLSON  
EXECUTIVE DIRECTOR

It is not often you can equate baseball with agriculture, but believe it or not, there are parallels.



OLSON.

Anyone who followed the Minnesota Twins this past season knows they had a terrific year. Their success was no fluke; the Twins won because they'd put together a group of home-grown players who grew and jelled together as a team. Rather than hoping to reverse their fortunes immediately by signing a group of high-priced free agents, the management took the time to develop young, raw, but talented players into a team.

The same blueprint can be followed for agriculture. New developments and market opportunities aren't free

agents to be purchased by the highest bidder. They must be recognized and then nurtured. AURI, Minnesota agriculture's research and development arm, is in the business of identifying and developing innovative agricultural products and processes.

In this issue of Ag Innovation News, we're focused less on where we've been in value-added agriculture. Instead, we look forward to emerging opportunities that run the gamut, from new food and personal care products to ways to utilize ag products for fertilizers, soil stabilizers, fuel sources, industrial products and more.

For some agricultural products, the future is now. After years of development, they are becoming market realities. Others are still young and raw and need some time for their potential to be fully realized.

But just as the Twins use Minnesota's own "farm system" to develop talent, AURI is leading the state's real farm system in developing value-added winners for Minnesota's economy.



Cindy Green, managing editor; Charles Smith-Dewey, designer; Deborah Hoeldtke, editing services; Rolf Hagberg, photography  
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# opportunities Bioproducts

## From plastic to adhesives, ag is replacing petro.

S P O T L I G H T

BY E. M. MORRISON

A century ago, the renowned botanist George Washington Carver made rubber from sweet potatoes, marble from wood shavings, and ink, dye and insulating board from peanuts. Working to solve the challenge of crop surpluses, he developed some 300 industrial uses for abundant, renewable peanuts.

Though George Washington Carver pointed the way 100 years ago, America is just beginning to tap the enormous industrial potential of plants.

"Since the early 1900s, we've devoted billions of dollars to petroleum research," says AURI Deputy Director Keith Sannes, a polymer chemist, "and we've developed thousands and thousands of petroleum products. In the last 20 years, we've started to do the same thing with materials we grow."

Over the next generation, scientists will make great advances in refining crops, says Roger Ruan, a University of Minnesota biosystems and agricultural engineer. Refineries will fractionate plant material into components that can be converted to all sorts of high-value products — adhesives, plastics, building materials, lubricants, solvents, paints, inks, textiles, fuels. At some point, Ruan predicts, "biorefining will replace petroleum refining."

That won't happen any time soon, though, cautions Max Norris, an AURI fats and oils scientist. The shift to a plant-dependent economy "will be an evolution, not a revolution."

Still, Norris says, several trends are encouraging the transition to biobased products. Strong consumer interest in biodegradables, concern for the environment, and political turmoil in oil-producing regions are creating a favorable climate for development. Government tax incentives and utilization targets are also fostering growth, he says. There's even a national marketing program in the works, called "Buy Bio."

Biobased industrial products are steadily entering the market. Mell's Industries of Des Moines, Iowa, for example, is making paper from cornstalk fiber. Urethane Soy Systems Co. of Princeton, Ill., has introduced spray foam insulation made from soybeans. Cargill Dow opened the first world-scale manufacturing plant for PLA, a fiber made from natural plant sugars. Other U.S. companies are making building panels from straw, packing peanuts from cornstarch, ink from soybeans, even disposable plates from cornstalks and limestone. ■

## Polymer dreams

*Roger Ruan breaks up ag fibers to make biodegradable polymers*

BY E. M. MORRISON

Distiller's grains, waste pulp, crop residues — they are the stuff of dreams for Roger Ruan, a University of Minnesota scientist.

Ruan is testing a chemical process that liquefies ag fibers for use in plastics, packaging films, foams, building materials, adhesives and a host of other manufactured goods. The research could lead to dozens of new commercial uses for ag fibers, giving farmers more markets for crop wastes; manufacturers get biodegradable, renewable raw materials.

"We know that some day our supplies of petroleum are going to run out," says Ruan, 39, a biosystems and agricultural engineer who leads a team of scientists and graduate students at the U of M's St. Paul campus. "Our focus is renewable products as substitutes for petroleum. We're trying to develop all kinds of processes to convert ag materials to useful consumer products."

A few years ago, AURI helped Ruan's team develop a method for high-pressure expansion of ultra-fine crop fibers. The process alters the physical properties of cellulose fibers such as sunflower hulls and corn stalks. The expanded fibers are useful in filters, time-release medicines, food additives, fertilizers and other products. AURI holds a joint patent on the process, which has been licensed to a Minnesota food company.

PHOTO BY ROLF HAGBERG



University of Minnesota scientist Roger Ruan is turning ag fibers into a liquid that can be substituted for petroleum in plastics, adhesives, building materials and other bioproducts.

Ruan's latest research uses a chemical process to break cellulose and other molecules into a liquid. The molecules are then recombined to make biodegradable polymers, which can replace petroleum-derived polymers in manufacturing.

Ruan, formerly a Pillsbury researcher, is one of the first scientists to try this total

liquefaction process on crop wastes, according to Keith Sannes, a polymer chemist and AURI deputy director in Crookston. Ruan is experimenting on a variety of plant fibers, including corn cobs, beet pulp, corn stover and distiller's grains.

These low-value materials are not economical to transport long distances. However, liquifying ag fibers for biopolymer production is fairly simple and could be done right on the farm or in the food processing plant, Ruan says. He envisions bulk trucks making the rounds to farms, much like milk trucks today, collecting polymer fluid.

The process is environmentally friendly, too, he says. "There are no emissions, no odor, no wastewater — no waste at all. It's complete utilization."

Ruan's research is attracting a lot of interest, especially from the ethanol industry, which is looking for new uses for distiller's grains, says Jack Johnson, head of AURI's coproducts lab in Waseca. The distiller's grain supply is expected to soar in the coming decade, depressing already low prices for the feed. Yet this surplus of cheap raw materials "could make biorefining more economical," speeding commercialization of plant-based polymers, Johnson says.

Ruan says the research will contribute to a new era in manufacturing. "We're at the very beginning of the biorefining industry. Within 10 years, we'll see major advances. This industry is going to be huge." ■

## CLOSE TO HOME: Nonfood and industrial projects in Minnesota



AURI has worked with dozens of Minnesota companies developing industrial and consumer products from plants.

Successful products like those highlighted below eventually mean new manufacturing plants and jobs in rural Minnesota, close to the supply of raw materials.

### Rust busters

#### Cortec industrial lubricants

*White Bear Lake, Minn.* — AURI helped Cortec Corporation replace mineral oil with renewable soy methyl esters in its EcoLine products for lubricating and protecting machinery.

The \$25-million company makes more than 300 corrosion-protection products for the electronics, construction, drilling, metalworking, food processing, automobile and marine industries. Customers include General Motors, Motorola, Boeing, Exxon, Ford and the military.

One of the first Minnesota companies to meet ISO 14001 environmental protection standards, Cortec is a global leader in biodegradable corrosion-control products, says Art Ahlbrecht, vice president for research and development.

One of Cortec's newest offerings is a biodegradable soy-based concrete preservative that protects newly poured concrete and inhibits corrosion. It is part of a soy-based product family that includes surface cleaners, cutting fluids, food machinery lubrication and heavy-duty greases.

Interest in plant-based lubricants is strong, especially in Europe, where Cortec does about a third of its sales, Ahlbrecht says. Biolubricants may be more expensive now but "as petroleum gets more expensive, we're going to have to move to renewables."

### Surfactant of Preference

#### AgriLiance soy-based herbicide adjuvants

*Inver Grove Heights, Minn.* — A decade after it was introduced, Preference has become a leading herbicide adjuvant.

The soy-based surfactant improves herbicides' effectiveness by making spray droplets adhere to weed leaves. It is the first non-ionic surfactant to use soapstock, a soy refining byproduct, instead of a petroleum derivative.

Preference and another soy-based adjuvant, Destiny, are marketed by AgriLiance, LLC. "Preference is our flagship non-ionic surfactant," says Bob Herzfeld, AgriLiance marketing manager who developed the products along with AURI scientists. "We're selling it in 38 states."

Preference outperforms similar petroleum-based surfactants and growers like using a crop-based product. It sold well after its 1992 introduction and was used on eight million acres by 1996.

When sales slumped due to the advent of herbicide-resistant crops, such as Round-Up Ready soybeans, AgriLiance began marketing Preference for sugar beets, cotton and post-emergent corn herbicides. Last year, sales again climbed to eight million acres, requiring soapstock from about six million bushels of refined soybeans.

AgriLiance is testing another soapstock product, Barrier, which controls hog manure odors and reduces hydrogen sulfide emissions in barns. It may also be used in municipal waste lagoons, paper mills and other industries.



### Slowly softening the market

#### SoySoft moisturizing lotion

*Grove City, Minn.* — At the Minnesota State Fair last August, AURI gave away thousands of soy-oil lotion samples. SoySoft got rave reviews from consumers, as it has for the past five years, says Dan Lemke, AURI communications director.

Since 1998, AURI has been helping Cliff and Lucy Larson market SoySoft moisturizing lotions. They are now distributed in 30 states.

Late last year, SoySoft picked up a major distributor, Mountain People, which supplies California and Colorado health food stores. Hospital gift shops have become good markets, as well as country elevators and farm stores, says Lucy, who still runs the company from her dining room table. "Men come in to get parts and pick up lotion."

In October, the Larsons introduced four-ounce bars of SoySoft Soap and are developing a soy oil sunscreen. "We're in a difficult market," and sales growth has been slow, Lucy admits. Yet last year a trade-show appearance generated a \$625,000 order, which the Larsons reluctantly turned down. "We don't yet have the production capacity."

### Swheatening the scoop

#### Pet Care Systems cat litter

*Detroit Lakes, Minn.* — It has been nearly 10 years since AURI began working with the makers of Swheat Scoop cat litter. Mike and Vonnie Hughes and their son, Mark, founders of Pet Care Systems, have since "doubled sales almost every year," Mark says.



AURI helped formulate the litter, made with nonfood wheat, and build a processing plant in 1996. The company introduced a crumbled litter that is more absorbent and works in self-cleaning litter boxes in 2001, the same year AURI honored Pet Care with its Ag Innovator of the Year award.

Last July, Pet Care Systems was sold to Farmers Union Marketing and Processing Association of Redwood Falls, a \$60 million diversified agribusiness, which also operates Central Bi-Products, Midwest Grease and Northland Choice, a pet food manufacturer. Mike and Mark Hughes continue to manage the company.

Pet Care Systems then mounted a \$1.5 million national ad campaign, combined with a \$5 million coupon promotion. Product demand surged. The company added a second production shift to meet orders and is building a 7,000-square-foot storage warehouse. Wheat use is now up to three truckloads a week, Mark says.

Swheat Scoop is sold in nearly 9,000 retail outlets, including Target, PetsMart, Petco, Pet Valu and Pet Supplies Plus stores. Last year, Pet Care Systems expanded into grocery stores, placing Swheat Scoop in 700 Kroger stores, plus retail chains in Utah, Arizona and Colorado. ■



PHOTOS BY ROLF HAGBERG

## ELSEWHERE in nonfood and industrial products

### Sunflower gloves?

Colorado State University and USDA-ARS researchers are trying to increase the natural rubber produced in sunflowers from 1 to 10 percent by cross-breeding with guayule, a rubber-producing plant, or by stimulating the sunflower's rubber gene. A commercial variety is at least eight years away.

Source: [www.ars.usda.gov/ars/ARLarchive/jun02/rubber0602.htm](http://www.ars.usda.gov/ars/ARLarchive/jun02/rubber0602.htm)

### Allfiber technology

An alliance between five organizations in the finance, engineering and construction

industries will help communities, farming groups and investors develop manufacturing complexes for ethanol, biodiesel, agrifiber board and hydroponics.

Source: [www.allfiber.com](http://www.allfiber.com); Gerry Hooper, Allfiber Group LLC, Decatur, AL, [ghooper@allfibers.com](mailto:ghooper@allfibers.com)

### Corn breaks under protease

USDA-ARS researchers have applied for a patent on a corn refining method that could lower costs and shorten the time to produce starch, oil and other coproducts. The method relies on protease enzymes to break down starch and protein and requires only a six-

hour pretreatment of corn kernels before milling.

Source: David B. Johnston, USDA-ARS Crop Conversion Science and Engineering Research Unit, Wyndmoor, PA, (215) 836-3756, e-mail [djohnston@arserc.gov](mailto:djohnston@arserc.gov)

### Feathers to filters

With more than nine billion chickens raised for food annually in the United States, the industry generates enormous quantities of feathers. USDA-ARS scientists have found a way to turn chicken feathers into strong, less-dense plastic composites for products as varied as car dashboards and boat exteriors.

Feathers make good paper and the superfine size and shape of feathers make them particularly well suited to filtration needs.

Already patented, the technology has been licensed to three companies, with two pilot plants already turning feathers into fiber.

Source: Walter F. Schmidt, USDA-ARS Environmental Quality Laboratory, Beltsville, MD, (301) 504-6765, [schmidt@ba.ars.usda.gov](mailto:schmidt@ba.ars.usda.gov) ■



# opportunities Biofuels

## Renewable resources gain energy markets.

### SPOTLIGHT

## So you want to build a biodiesel plant?

*Handbook helps local groups assess plant feasibility*

BY DAN LEMKE

Biodiesel proponents were victorious last March when Minnesota lawmakers passed a statewide mandate requiring biodiesel usage. The legislation calls for all diesel fuel sold in the state to contain two percent biodiesel.

A key requirement for the measure to take effect, however, is that Minnesota reach a biodiesel production capacity of eight million gallons by 2005. To help make that happen, AURI and the Minnesota Soybean Research and Promotion Council have teamed up to produce a biodiesel handbook. They hired the Independent Biodiesel Feasibility Group, a Kansas City engineering consulting firm, to produce it.

### Measuring tool

"This is really a tool for producers and communities to assess whether a biodiesel production facility is feasible for their situation," says Michael Sparby, AURI project director in Morris. "This does not replace a site-specific study; instead this will help groups decide whether or not it's worth spending the money to proceed with a study of their particular site."

It instructs groups interested in building biodiesel plants on how to review factors such as feedstock sources, available production processes, base catalyst sources and markets.

"Feedstock sources, whether vegetable oil like soybean or canola, or animal fats like grease or rendered recycled oils, are about 75 to 80 percent of the production cost," Sparby says. "So that is by far the largest factor."

The handbook compares plant costs and the pros and cons of batch and continuous flow processes. Other issues addressed, such as building process flow, transportation, water treatment and employment, can help readers assess their local situation.

"We developed this as a screening tool to help groups make educated decisions," says Rose Patzer, AURI chemist in Marshall. "We don't have any production in the state right now, but we do have some large companies interested

in building here. We're trying to help smaller groups be players in this industry."

### Thinking ahead

"The provision — that Minnesota produce eight million gallons of biodiesel — will provide for rural development," says Minnesota Soybean Growers President Kristin Weeks-Duncanson. "Biodiesel is definitely a part of the national energy plan, and I'm proud to represent Minnesota, the first state in the United States to require its use."

While building biodiesel capacity is key to getting the industry started, increasing demand for the fuel is also vital.

"We are working to drive demand for biodiesel within the ag sector first," says Scott Singlestead of the Minnesota Soybean Research and Promotion Council. "We want producers to use it and request it because the infrastructure for handling biodiesel needs to be established."

As the state opens the door to the biodiesel industry, others are interested in following Minnesota's lead. "This is the first time anything like this has been published," Sparby says. "There's extreme interest in Minnesota, among other states and even from countries like Australia, the Netherlands and Puerto Rico."

A series of presentations are scheduled throughout Minnesota to expand on the handbook's information. ■

BY DAN LEMKE

Biobased fuels may be the largest growth area for agricultural product utilization in the next decade. From individual farming operations to municipal utilities, energy consumers are intrigued by renewable fuels.

"There is real interest," says Jack Johnson, AURI director of engineering services.

"Concerns over energy reliance, fluctuating fuel costs, (the environment) and increasing cost effectiveness of renewable fuels are some of the reasons why individuals and industries are taking a closer look."

Minnesota is leading the way in research and promotion of many ag-based fuels — with 15 operating ethanol plants, the only statewide mandate for biodiesel in the country, leading-edge research on solid renewable fuels, and construction of the nation's first turkey-litter powered plant moving ahead.

"Energy is one of our largest focuses," says Yvonne Simon of the Minnesota Corn Growers Association. "It's not just ethanol, but E-diesel, E-85 and fuel cells."

The U.S. ethanol industry has grown to about one billion gallons per year. Federal forecasts show renewable electrical generation from biomass, landfill gas, geothermal energy and windpower shows promise as well.

"The largest increase is projected for biomass, from 36.6 billion kilowatt-hours in 1999 to 65.7 billion in 2020," according to the Annual Energy Outlook 2001 report by the U.S. Department of Energy's statistical agency.

Energy from renewable resources means an agriculturally-powered economy, Johnson says. "We need to assess what people are willing to pay for self reliance." ■



PHOTO BY ROLF HAGBERG





## CLOSE TO HOME: Biofuels and energy products in Minnesota

AURI is working with farmers, energy suppliers and large consumers to promote and deliver renewable energy sources for a variety of applications, from home heating to municipal power.

### Liquids at the fore *Ethanol and biodiesel*

Although liquid fuels like ethanol and biodiesel have gained momentum and acceptance, they are not new. Henry Ford designed his first Model T to run on ethanol, and more than a century ago, Rudolf Diesel's prototype engine was built to run on vegetable oil.

In Minnesota today, 15 ethanol plants generate 367 million gallons per year. Minnesota has more E-85 pumps than any other state: 70 in all. E-85 is an 85 percent ethanol-15 percent gasoline blend that can be burned in flexible fuel vehicles built by Daimler-Chrysler, Ford-Mercury, Isuzu, Mazda and General Motors.

"We are working to inform car dealerships so they can educate consumers about the flexible fuel vehicles. Helping both groups understand the benefits of using E-85 is the challenge," Simon says.

Current U.S. ethanol production is largely based on grain or starch sources. But advanced technology can produce ethanol from cellulose materials such as corn stover, ag residues and wastes from food and industrial processing. Several companies are investigating this technology as a possible means of ethanol production, says Jack Johnson, head of AURI's coproducts lab in Waseca.

The U.S. Department of Energy National Biofuels Program is supporting research and development of advanced ethanol technology and has set a goal to have commercial demonstration plants using ag residues in operation by 2005.

EB-diesel, an ethanol-biodiesel blend, is being tested by the automotive technology department at Minnesota State University-Mankato. Biodiesel has advantages over petroleum diesel in areas such as lubricity; ethanol helps reduce emissions. John Deere will begin testing EB-diesel in tractor and combine applications. Simon says the evaluation may carry over into construction equipment and generators.

### Solid fuels coming up *Biomass energy*

Liquid fuels are far from the only ag-based fuels garnering attention. Solid fuels such as grains, ag processing coproducts, crop residue, even poultry litter and manure are

PHOTO BY ROLF HAGBERG



Anaerobic digesters, such as this facility on Dennis and Marsha Habenschild's dairy farm near Princeton, Minn., capture methane gas that is converted to heat or electricity.

receiving serious consideration as sources for heat and electricity.

"Many solid renewable fuels are more economical to burn than wood, oil or gas," says AURI engineer Jack Johnson. "Energy prices will affect their attractiveness, but we expect them to become even more viable."

Several Minnesota power plants, including one in Elk River, now generate heat or electricity by burning wood and biomass such as garbage. Johnson says there is interest among Minnesota municipal power providers and large energy consumers in using renewables such as dry distiller's grains and corn.

"Companies that currently burn wood are interested in renewables because wood is in short supply and the cost is getting higher," Johnson says. "In many cases renewables can be burned more economically than other fuels. Coal is still cheaper, but companies burning coal are interested in renewable fuels to help them meet environmental standards."

When natural gas prices went up last year, several energy consumers approached AURI for help with alternative fuels. While prices fluctuate, Johnson says natural gas costs roughly \$5 per million Btu, while corn, for example, costs about \$3 per million Btu.

One energy supplier, Hill Wood Products in Cook, Minn., has successfully used ag residues in its facility to provide power to US Steel's Minntac plant in Mountain Iron, Minn.

While demand is growing, transporting renewable biomass to end users is one challenge preventing large-scale use of biomass energy; costs can become prohibitive.

### Harnessing methane *Anaerobic digesters*

Anaerobic bacteria gives off methane gas as they digest solids such as manure, municipal sludge or ag processing residue. The methane can be captured by anaerobic digesters, burned for heat or used to generate electricity, while the now-stabilized solid waste can be applied to land.

Digesters are frequently considered in connection with large-scale dairy operations handling large amounts of manure. While the technology is proven, economics play the biggest role in whether or not a digester is viable.

"The technology works," Johnson says. "If an operation is able to sell electricity back to the utility and receive a favorable rate, it's much closer to economic feasibility. If they can contract at a 'green rate' of 7 or 8 cents per kilowatt-hour, it may work. Others may need to rely on subsidies to make the economics work." Commingling food processing or municipal wastes with manure in on-farm digesters may also be another option to improve cost-effectiveness.

### Turkey power *Fibrominn*

Benson, Minn. — The nation's first turkey-litter powered electrical plant is expected to begin construction this spring. In late October, Fibrominn received a vital air quality permit from the Minnesota Pollution Control Agency that cleared the way for construction.

The Fibrominn plant will consume up to 500,000 tons of turkey litter, alfalfa stems and other material to create 50 megawatts of renewable energy annually. Construction of the \$100 million facility is expected to take about two years. It will help Excel Energy meet a state mandate to use 125 megawatts of renewable energy.

Environmental regulations governing feedlots and land application of animal waste is expected to increase the demand for Fibrominn's technology in other locations. Fibrominn's parent company, Fibrowatt, already operates several poultry-litter powered plants in the United Kingdom.

### Corn is cheaper *Biomass stoves*

Elk River, Minn. — Bixby Energy Systems of Elk River produces biomass stoves for home heating with an eye towards broader developments including distributed power from renewable sources. Company president Bob Walker says economics, diminishing fossil fuel reserves and energy self-reliance are

driving Bixby Energy's interest in renewable, ag-based fuels.

"The number one reason is that biomass is an economical method of heating," says Walker. "Corn has been a real cost-effective method of generating heat. Our pellets are as cheap or cheaper. Biomass will play a vital part in supplying the energy we need. It just needs to be put in a form that people can handle."

Bixby Energy Systems, which Walker hopes to turn into the "Microsoft of biomass," has worked with AURI to develop clean-burning ag based pellets that deliver a guaranteed amount of heat.

## Visions of the future Fuel cells

Though not yet widely used, fuel cells show promise for the vision of an ag-powered economy. An electrochemical energy conversion device, a fuel cell converts hydrogen into electricity and heat. Much like a battery that can be recharged while power is being drawn, the fuel cell uses hydrogen rather than electricity to recharge.

Minnesota's corn growers are interested in fuel cells because ethanol has hydrogen in its molecular makeup. Hydrogen atoms are released in the breakdown of ethanol molecules and can be captured to provide fuel for fuel cells.

Fuel cells could be used to power motors, lights, electrical appliances, cars, buses and even provide power for a home.

## From chicken fat to beef tallow Recycled grease for boiler fuel

Plant biomass is not the only stuff of renewable fuels. Yellow and white greases, beef tallow and chicken fat have been evaluated for their boiler fuel potential by the national Fats and Proteins Research Foundation, which is investigating new uses for rendered fat. The study, completed June 2002 by the University of Georgia, shows that combustion emissions and the Btu values of fats and oils compare favorably to No. 2 fuel oil.

An FPRF member, Central Bi-Products of Redwood Falls and Long Prairie, Minn., conducted a similar study the winter of 2000. The rendering company compared the Btu values of recycled grease and natural gas; its findings were consistent with the University of Georgia study. Chuck Neece, Central Bi-Products research and development director, says the results give credibility to this alternative fuels source.

"As the price of natural gas goes up, recycled greases become a viable fuel source," Neece says. "Particularly in stationary equipment, the recycled greases become very economical to use, whether in a generator or boiler."

Neece says sulfur compound emissions are lower in recycled grease than No. 2 fuel oil, and the renewable material has good potential as a low-sulfur fuel. ■



Mike Duame (left), fuel division manager, and Steve Hill, owner of Hill Wood Products in Cook, Minn., are turning wood and ag products into a fine powder that burns as fuel.

PHOTO BY ROLF HAGBERG

## ELSEWHERE in biofuels and energy

### Gambling on biodiesel

The Clark County school district in Las Vegas recently switched over a thousand school buses to biodiesel — making it the world's largest school bus fleet to run on biodiesel.

Several independent studies indicate that the more than 25 million children who ride school buses face up to eight times greater exposure to toxic diesel exhaust than if they walked. Biodiesel significantly reduces the harmful emissions that threaten human health.

Las Vegas-based Biodiesel Industries collects French fry oil from casinos to make biodiesel that fuels the buses.

Source: National Biodiesel Board, 1-800-841-5849.  
www.biodiesel.org.

### Flying colors

Biodiesel is the only alternative fuel to pass the rigorous health-effects testing of the Clean Air Act. Two years of independent studies show that, compared to diesel fuel, biodiesel reduces carcinogenic emissions by 75 to 90 percent, is low in toxicity, readily biodegradable and free of sulfur.

Source: National Biodiesel Board, 1-800-841-5849,  
www.biodiesel.org.

### Ditching MTBE

Exxon Mobil, the world's largest oil company, is switching from MTBE to ethanol in its California gasoline early this year. Ethanol will replace MTBE for four of California's five major oil refiners. And Phillips Petroleum Co. has become the first gasoline retailer in California to offer MTBE-free gasoline year-round at all its 1,500 outlets.

Source: Renewable Fuels Association,  
www.ethanolrfa.org

### Net energy yield

A new USDA study confirms the energy efficiency of ethanol. "The Energy Balance of Corn Ethanol: An Update" concludes that ethanol production is energy efficient because it yields 34 percent more energy than is used in growing, harvesting and distilling corn.

Source: www.newuses.org. Report is available at  
www.usda.gov/loce

### Spinning straw into fuel

The Rice Straw Cooperative and the town of Gridley, Calif. have secured more than \$100,000 in state and federal grants to build a facility to make ethanol from rice straw. The goal is to have a plant up and running by July.

Source: Progressive Farmer, September 2002.

### Breaking records

The ethanol industry is expected to produce a record 2.7 billion gallons in 2003. Last year, 66 ethanol plants produced more than 2.5 billion gallons annually. Three more plants recently came on line and eight more are under construction.

Source: Renewable Fuels Association,  
www.ethanolrfa.org

### Ethanol plants pop up

Farmer-owners of KAAPA Ethanol, LLC, have begun building an ethanol plant near Axtell, Neb. KAAPA is one of two new ethanol plants currently under construction in Nebraska, which now has seven plants.

In South Dakota, Progressive Energies, LLC in Platte, and Glacial Lakes Energy, LLC in Watertown recently began constructing ethanol plants.

Adkins Energy LLC, Lena, Ill. has completed the first farmer-owned ethanol plant in Illinois; it includes a co-generation facility to produce steam and electricity for the plant.

In Wisconsin, Badger State Ethanol, LLC in Monroe began ethanol production this fall.

Source: Renewable Fuels Association,  
www.ethanolrfa.org

### To ethanol or not

With 70 to 80 new U.S. ethanol plants now planned or begun, concern is growing that the industry could hit over-capacity in three to five years. Kansas State University ag economist David Coltrain has developed an "Ethanol Pre-Feasibility Evaluator," with a downloadable spreadsheet, to help potential ethanol investors.

Source: Successful Farming, October 2002.  
Report at www.teambas.com/ksusrc/ksutop.php  
or contact David Coltrain, (785) 532-1523,  
coltrain@agecon.ksu.edu

### Clean energy in farm bill

The Clean Energy Development Provision, or Title IX of the Farm Security and Rural Investment Act of 2002, provides \$115 million to assist farmers and ranchers in developing renewable energy and making energy efficiency improvements on their farms. It also designates \$290 million for biomass energy research and biodiesel education and would continue subsidizing, under the Commodity Credit Corp. program, biodiesel and ethanol production.

Another amendment to the rural development legislation makes wind power, other renewable energy sources and energy efficiency eligible for hundreds of millions of dollars of funding.

Source: The Land, Southeastern Edition,  
September 27, 2002. ■



# opportunities

## Nutraceuticals and pharmaceuticals

Market is growing rapidly for medicinal foods.

BY CINDY GREEN

Comfort foods — steaming oatmeal, spaghetti with tomato sauce, roast beef with garlic potatoes — are good not only for the soul, but also the heart and immune system.

Oatmeal contains beta glucan fibers that reduce cholesterol; lycopene in spaghetti sauce may reduce the risk of prostate cancer; psyllium fibers in pasta may reduce the risk of cardiovascular disease; the CLA in beef could reduce some tumors and body fat; garlic contains diallyl sulfide, which lowers LDL cholesterol.

The food industry calls such products and ingredients nutraceuticals or functional foods. “If you ask me, all foods are functional,” says Charan Wadhawan, AURI food scientist. “It really goes back to the basics — eating whole foods in moderation. But some foods may be more beneficial than others.”

Lisa Gjersvik, AURI project director in Waseca, says medicinal food is a major emerging opportunity in value-added agriculture. The current U.S. nutraceutical market is \$16.7 billion and is expected to grow to \$28 billion by 2006.

When a study confirms, or at least suggests, that a food component may treat or prevent disease, food companies quickly respond.

A California wine maker has capitalized on the 1979 “French Paradox” report that linked wine consumption to lower rates of heart disease, attributed to phenols in grape skin. A subsidiary is marketing grape extracts to companies that make herbal supplements, food products and beverages.

The Fluid Milk Strategic Thinking Initiative, funded nationally by dairy producers and processors, is looking at 12 ingredients that could be added to milk, including beta glucans for heart health, glucosamine for joints, lutein for vision, S-adenosyl-L-methionine to elevate mood, and green tea extracts rich in antioxidants.



PHOTO BY ROLF HAGBERG

### Shifting to food-meds

The Hartman Group, a leading market research firm, says rising interest in medicinal foods reflects a shift in Americans’ consciousness, heightened by September 11. The firm’s report, “The Wellness Trends in 2002,” found that people are putting family and wellness above hectic daily routines. Many interviewed said they were frustrated with the U.S. healthcare system, wanted more control over their health, were concerned about aging, or had gone through life-transforming experiences such as cancer.

“Dietary supplements ... (allow) them a way of self-managing their own health ... giving them a sense of empowerment,” the report states.

The Hartman Group finds 13 percent of U.S. households score high on wellness indicators, including regular exercise, healthy eating, using supplements and buying organic and natural foods. The biggest group, 62 percent, score in the mid range, and 24 percent rate low. The findings show the

market for wellness products and services is vast, the report says.

Last year, a study of consumer attitudes toward functional foods by the International Food Information Council showed 89 percent of Americans believe they have at least moderate control over their health and 93 percent believe that some foods have health benefits that go beyond basic nutrition; almost 62 percent are incorporating at least one food for health benefits.

Other economic realities could increase the popularity of nutraceuticals. Gregg Wurster, a Duke University graduate student, predicts that as health insurance costs continue to rise, consumers will pay higher co-pays for drugs. Nutraceuticals will present a better economic value to those consumers than they did in the past. “They will become more conscious of ways to prevent those expenses,” he writes in the Nutraceutical World magazine, September 2002.

### Research is booming

Nutraceuticals were defined in 1994 by the Institute of Medicine’s food and nutrition board as “any food or food ingredient that may provide a health benefit beyond the traditional nutrients it contains.” The main focus has been on phytochemicals — biologically active chemicals such as glucosinolates in cruciferous vegetables (cole crops), lycopene in tomatoes, limonoids in citrus fruits, lignans in flaxseed and catechins in tea — all purported cancer fighters.

The fastest growing nutraceutical market is weight-loss products, according to the Nutrition Business Journal. With more than 120 million overweight Americans and 17 million diabetics, demand is growing for foods or supplements that increase metabolism, suppress or satiate appetite, and control blood sugar.

While many claims have not been replicated in clinical trials, research facilities are going up around the country to study the medicinal qualities of food components, such as the Nutraceuticals Institute, a partnership between Rutgers University, St. Joseph’s University and the State University of New Jersey.

The University of Manitoba in Canada is establishing a \$25 million Research and Development Centre for Functional Foods and Nutraceuticals to study prairie crops such as oats, wheat, buckwheat, canola, flax and hemp. The University of Minnesota’s Center for Spirituality and Healing is designing a program to “implement well-designed, scientifically rigorous clinical investigations of botanical medicines and dietary supplements to determine their safety and use in treating illnesses,” according to the Center’s Web site.



AURI recently launched a Functional Foods Initiative to look at the medicinal qualities of locally-grown grains, beans and oilseed crops. The initiative will be led by Wadhawan and Michael Sparby, AURI project director in Morris.

### Drugs from the field

Nutraceuticals are not the same as pharmaceuticals, such as plant-derived proteins for vaccines and medical treatments. Pharmaceuticals are designed specifically for medical use under a physician’s supervision, and are subject to FDA approval.

There are 400 plant-based drugs under development worldwide, according to a National Corn Growers Association study. A January 2002 article in Top Producer magazine reports: “estimates of crop acres needed to serve this new drug market range from ‘tens of thousands’ to as many as one million.” Nevertheless, planting genetically-engineered crops for drug harvesting is controversial because of concerns over pollen drift and genetic contamination of traditional crops.

Nutraceuticals, which do not pose an environmental hazard, may be easier and faster to market. Farmers could gain from raising specialty crops such as garlic, cranberries and chicory with disease-fighting properties. Numerous new businesses in Minnesota are taking advantage of promising new markets for medicinal foods. ■

## S P O T L I G H T

## Pioneers in carbohydrates

*Biorefining puts patent to work extracting nutraceutical ingredients*

BY CINDY GREEN

**Minneapolis, Minn.** — Biorefining, Inc. wants to turn a dime's worth of raw material into medicinal components worth hundreds of dollars — and do it more efficiently than anyone else.

The start-up company's technology is designed to extract high-value components from carbohydrates found in distiller's dried grains, sugar beet pulp, citrus pulp and soybeans. Extract uses range from sport drink additives to fluoride replacements.

### Minus the water

Typically, carbohydrates are fractionated with a water-based process using 90 pounds of water for every 10 pounds of material. Biorefining's patented Thorre Process essentially eliminates water; "we can extract more efficiently" at a lower cost, says Thom Menie, vice president of sales and marketing.

Products from the Thorre Process will be able to compete on an economic and functional level with a multitude of petroleum and biobased products, states a company document.

Materials like distiller's dried grains (DDGs), an ethanol byproduct, can yield such high-value extracts as:

- **Xylose:** a low-calorie sweetener and fluoride replacement; current market price of \$6.60 to \$7.00 per kilogram.
- **L-arabinose:** used in a Hepatitis-B treatment and as a sucrose inhibitor for diabetic and weight loss applications; current price \$100 to \$140 per kilogram.
- **Galactose:** plant-based, low-calorie sweetener and an energy additive in sport drinks and bars; current price \$125 to \$150 per kilogram.
- **Galacturonic acid:** a nutrient for functional foods, a replacement for phosphates in detergents and a biodegradable surfactant; current price \$150 to \$280 per kilogram.

While increased supply of these fractions will inevitably lower their market price, nutraceuticals and pharmaceuticals are still far more profitable than livestock feed, which values DDGs at about 11 cents per kilogram.

### Carb chem finesse

The dry extraction process was invented by Doug Van Thorre, a former dentist with a physics and chemistry background. His work as an FDA clinical investigator on dentistry led to other medical research and eventually to carbohydrate fractionation. Menie met



PHOTOS BY ROLF HAGBERG



Biorefining, Inc. is using a new, patented technology to fractionate carbohydrates from dried distiller's grain (above right) and other raw materials into high-value components for products such as low-calorie sweeteners, nutritional drinks, pharmaceuticals and weight-loss products. Biorefining's team, from the left, includes: Kim Plahn, CFO; Doug Van Thorre, inventor of the extraction process; Wesley Hayne, CEO; and Thom Menie, vice president of sales and marketing.

him in the early 1990s when Van Thorre was scientific advisor on a wastewater treatment project.

In the late 1990s, Menie learned of Van Thorre's carbohydrate work; they decided to seek a patent and start a company. "We sat in a room with three patent attorneys — all Ph.D.s — and they were basically blown away. This was a process that could revolutionize the way people process carbohydrates — it's called a pioneering patent."

At the meeting was Wesley Hayne, a former computer software CEO with substantial investment banking experience. "That meeting convinced Wes ... to become full-time CEO of Biorefining." Later Kim Plahn, with 17 years of financial experience, joined as CFO. "I've never seen a team as good as this company has," says Menie, who has 28 years' sales experience with such companies as Pillsbury, Johnson & Johnson and Oscar Mayer.

### Starting out sweet

When Biorefining incorporated on January 21, 2001, it was called Sweet Beet, Inc. because the company's first order was for

pentose sugar L-arabinose from beet pulp. "That's what got us going — we found out one plant alone was throwing off 300,000 tons of sugar beet pulp. We knew there was ample raw material at low cost."

"But now the sugar industry is not doing well ... and we're seeing a lot of aggressiveness in the ethanol industry," Menie says. Because the target components can be extracted from DDGs or "anything that is cellulose-based biomass," including citrus pulp and soybeans, Sweet Beet became Biorefining, Inc.

Minnesota's 15 ethanol plants each produce 13 to 40 million gallons of fuel per year. "There are 3,000 tons of distiller grains for every million gallons of ethanol — up to 20,000 tons of distiller grain per plant — that's a load," Menie says. "There's only so much you can put into (livestock feed); they have to find other ways of adding value."

### Back it around

Ideally, ethanol should be a byproduct of Biorefining's extraction process, rather than the other way around, Menie says. Extract pharmaceutical ingredients from corn first, and ethanol producers "end up with what is

essentially starch and glucose, easier for them to ferment. ... Ethanol becomes the sidestream — nothing goes to waste; we totally maximize utilization of the crop." Also, the biomass doesn't have to be dried, which reduces pollution. Menie says up to 80 percent of ethanol smokestack VOC (volatile organic compound) emissions come from drying distiller's grains and syrup.

Biorefining wants to "hook up with co-ops to get farmers involved in a bigger profit trail," although Menie says it will also work with privately-owned plants. In October, Biorefining signed a joint venture letter of intent with an ethanol plant in Stanley, Wis. The company is also talking to two ethanol cooperatives and an investor group in southern Minnesota. AURI is assisting Biorefining with process optimization studies and further technology development.

"We take what Mother Nature gives us and keep fractionating — we could end up with 20 or 30 (components), some valued at \$4,000 to \$6,000 a kilo," Menie says. "We expect to be inherently more profitable than anybody else in our industry." ■



## CLOSE TO HOME: Nutraceutical projects in Minnesota

wants food not only to taste good, but also to keep them healthier and ward off disease. Following are some of the AURI clients finding nutraceuticals to be a profitable niche market.

*Please note: Many health claims of nutraceuticals have not been reviewed by the FDA, and Ag Innovation News does not necessarily imply endorsement of such claims.*



### Drink to feel good Kefir with FOS

*Sauk Centre, Minn.* — “Let medicine be your food and food be your medicine.”

Hippocrates could have been referring to fructooligosaccharides, from the fiber of chicory roots, which have been consumed since his time. Today, FOS is a key ingredient in Helios Nutrition Organic Kefir, a fermented dairy beverage produced by George Economy, founder of Helios Nutrition Ltd. He also produces rBGH-free and organic milk and ice cream at Pride of Main Street Dairy.

Kefir, the Turkish term for “good feeling,” contains more than 30 strains of seven beneficial bacteria and yeast — up to 1,000 times more live organisms than yogurt. The added FOS multiplies bifidobacteria by five times in the gastrointestinal tract and helps the body absorb calcium and other minerals and vitamins. “The GI tract contains 100

trillion microorganisms weighing more than three pounds ... over half the body’s immune system. If you have a healthy system, you are less susceptible to bacterial infections and chronic illnesses such as asthma, food allergies, yeast infections and so on,” Economy says.

Helios Nutrition Organic Kefir is available in plain, raspberry, peach and vanilla flavors in Midwest food co-ops and grocers such as Coborn’s, Cash Wise, Cub, Byerly’s and Kowalski’s.

### Puffs accent the eyes Organic Foods snacks

*Waconia, Minn.* — At Organic Foods, Inc., the focus is on eyes. The manufacturer of ready-to-eat organic foods is adding lutein to a puffed cereal and snack food made with Hilylsine corn. Some studies suggest lutein may reduce cataract formation and retinal diseases.

AURI is helping analyze the nutritional value of the snacks, now in test production. Organic Foods makes a variety of other products including hummus, cookies and burrito-like “Healthy Wraps” in 10 flavors, such as Mediterranean, Tex-Mex, Spicy Thai and Japanese with Toasted Sesame Seeds.

### Bite of bread makes medicine go down French Meadow Bakery

*Minneapolis, Minn.* — Lynn Gordon, president of French Meadow Bakery, makes organic bread with medicine in every slice. “Women’s Bread” contains 80 mg of soy isoflavones, which may help ease symptoms of PMS and menopause. The bread is loaded with healthy ingredients — oat fiber, rice bran, sesame and sunflower seeds, quinoa, amaranth, sprouted grains, cranberries and flaxseed. “The essential fatty acids omega 3, 6 and 9 found in flaxseeds actually increase the body’s metabolic rate in addition to helping your skin, hair and body stay healthy,” states French Meadow’s Web site.

“Men’s Bread” is a high-protein, high-fiber bread with prostate-friendly saw palmetto. French Meadow claims it “provides the necessary nutrients ... for long-lasting energy



PHOTOS BY ROLF HAGBERG

and physical endurance.” Other “functional food” breads offered by French Meadow include “Healthseed Spelt” with sprouted grains and “Healthy Hemp” that the baker claims “contains the highest amount of protein and fiber of any bread available.”

### Planting what’s hot Specialty crops

Some Minnesota farmers are taking advantage of the nutraceutical craze by planting high-value specialty crops. Canola, a cool-season crop grown primarily in Canada and North Dakota, is an increasingly popular alternative to growing small grains in northern Minnesota. The oil is low in saturated fat and rich in omega-3 fatty acid.

Cranberries, grown in northern Minnesota bogs, contain tannins and anthocyanines purported to help prevent bladder infections. The lignans in rye and flax may protect against heart disease and some cancers. Chicory, a root crop harvested with sugar beet equipment, is a good source of fructooligosaccharides, which nourish healthy bacteria in the digestive system. Other crops touted as cancer fighters that can yield high prices on small acreage include garlic, carrots, broccoli and other cole crops.

### Good fat from grass Farm-direct grazed dairy products

Meat and milk from grass-fed cattle are claimed to have high levels of nutrients such

as omega-3 fatty acids, beta carotene and conjugated linoleic acid. Some farmers and processors are taking advantage of those claims and marketing products from grazed livestock not fed antibiotics or hormones.

Whole Farm Cooperative, a 30-member farmer marketing group, sells Grazer’s cheese and milk, along with other natural products, through Twin Cities churches. PastureLand Cooperative, representing six southeast Minnesota dairy producers who use intensive rotational grazing, sells natural cheeses to food co-ops and grocers in the Rochester area. Cedar Summit Farm in New Prague, which promotes the omega-3 content of its products, recently opened an on-farm creamery to produce milk, butter, yogurt, ice cream and cheese.

Omega-3 is an essential fatty acid that promotes lean muscle mass, helps fight cancer and converts fat to energy. Beta carotene is claimed to reduce cancer risk and CLA may hamper some tumors and reduce body fat. ■



## ELSEWHERE in nutraceuticals and pharmaceuticals

### Super red stuff

Scientists at Purdue University and ARS have developed a tomato that contains 3.5 times the cancer-fighting antioxidant lycopene.

*Source: Focus on Agriculture, American Farm Bureau Federation, July 1, 2002, www.fb.org/views/focus/index.html.*

### Beef’s a star

Beef producers from Nebraska, Kansas and Missouri spotlighted the healthy aspects of beef during the 4th Annual Conference on Treatment and Prevention of Obesity, held in Kansas City, Mo. There is evidence that conjugated linoleic acid, a nutrient found in beef, may help battle obesity and certain diseases.

*Source: About Agriculture, October 13, 2002.*

### More fishy fats

Southern Illinois University Carbondale researchers are working to boost levels of omega-3 fatty acids in farm-raised fish. A three-year \$600,000 grant from the National Science Foundation’s Partnership of Innovation program is funding the research.

*Source: Southern Illinois University Public Affairs, (618) 453-2276, siu7cnews@siu.edu.*

### Grass-fed is king

According to University of Georgia meat scientist Susan Duckett, grass-fed beef provides 75 percent less total fat, higher levels of antioxidants, vitamin E and beta-carotene, and an 1:1 ratio of omega-6 to omega-3 fatty

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# opportunities

## New food products

Exports and niche markets reward food innovators.

BY GREG BOOTH

Maybe the way to consumers' hearts is through the stomach, but the food industry can get closer to their pocketbooks by stressing convenience, health and safety, according to AURI meat scientist Darrell Bartholomew. Along with tasty, healthy food, consumers look for quick and easy meals, he says, and product success often comes with an astute combination of both.

"We're seeing more companies get into niches like snack foods," observes Jeff Phillips, an international trade representative with the Minnesota Trade Office. "The specialty food and gourmet niche is one that small companies tend to delve into in the beginning;" those specialty items often include organic and natural foods. Small companies also are "good at private label products, where they don't need to be out promoting their brands, competing with big companies."

### To Korea and beyond

One area of continued focus and growth for U.S. food producers is foreign markets. Minnesota's major food exports are breads, baked goods and pasta, according to the Minnesota Trade Office.

"In general, all exports are growing," Phillips says, but growth is strongest in private label and food service products. "Generally, over half of the food exports from the United States are to Canada. In Southeast Asia and China, there's a big increase in food service establishments. For example, Hormel is the main supplier of pepperoni products for Pizza Hut in China."

Retail sales, Phillips adds, are more difficult, and require a promotion budget typical of a large corporation. General Mills' Bugles are tailored to Chinese palates and selling well, and Act II microwave popcorn from Golden Valley, Minn., is selling well in Asia, he says.

Minnesota food product exports totaled \$666 million in 2001, the most recent year for which complete figures are

available, according to the Minnesota Department of Trade and Economic Development. That was down 1.3 percent from the previous year.

Yet while exports to Canada, the biggest importer of Minnesota foods, declined by eight percent in 2001, exports to Korea grew by 30 percent — a \$10 million increase. Korea is Minnesota's third largest foreign market for food products.

"We should see steady increases in Korea, in particular, for snacks and health foods. There's a strong organic market there," Phillips says. The Minnesota Trade Office hosts private label buyers from Japan and Korea who are interested in organic products.

### Organics are out there

Another opportunity in the U.S. food industry is in organic and natural foods, growing at about 15 percent per year, Bartholomew says.

USDA national standards for organic foods, issued in October 2002, "will be good for business," Phillips says, but in the short term, the rules may add some headaches as small companies gear up to comply with labeling requirements. The standardized labeling should make informed shopping easier for consumers of organic products.

The organic market is "clearly an area that has growth opportunity," Bartholomew says. "We have worked with a processor called Organic Valley out of Wisconsin, which has producers in Minnesota, that's strictly organic. We've worked with them on . . . value-added products where they didn't want nitrite in the product, such as bratwurst."

Other AURI clients include Pastures A Plenty in Clara City, marketing nitrite-free pork products, and Coleman Natural Beef, selling hot dogs with no added nitrates. Bartholomew says nitrite-free meats are "a growing market area." ■

## SPOTLIGHT

### A puff of fresh carrot

*MDV pushes the package for dried vegetables*



PHOTOS BY ROLF HAGBERG

BY GREG BOOTH

*Fosston, Minn.* — Who says you can't teach an old carrot new tricks?

Over the past 14 years, through tightened export markets and a fire in 1997, Minnesota Dehydrated Vegetables stayed alive by finding new ways to market old favorites. Its most recent success: puffed dried carrots that can be

rejuvenated to their original state in three microwave minutes.

When export markets slowed last year after September 11, "we turned around" and went into puffed carrots, says sales manager Jim Noyes. The instant veggies are in high demand

**CARROTS to next page**

## CARROTS from previous page

with domestic manufacturers of soups and other instant foods, he says. "It's a quality product, and it exceeds a lot of the specifications set by the customers."

MDV's other major lines are cross-cut carrots, carrots for pet foods, potatoes for hashes and soup mixes, and blended vegetables. Customers include packers for institutional food lines, instant soup companies and premium pet food manufacturers.

"We contract all our carrots prior to planting," Noyes says. MDV also buys carrots on the cull market from other packers.

From its beginning, MDV has received AURI technical help as it developed new products. Currently under development, Noyes says, are instant potatoes, instant wild rice and instant beans. Processed at MDV's Fosston plant, the foods are prepared to have the "ability to rehydrate at a rapid rate in the microwave," Noyes says. Potential customers include large name-brand manufacturers of quick-to-prepare meals.

Other new markets for MDV, Noyes says, include small package sales and bidding on government contracts for institutional food packages.

And even with last year's economic slowdown, Noyes says, "I see a lot more European markets (and other) export markets becoming available right now — some due to the dollar, some due to (our) quality standards."

MDV employs about 70 workers and had annual sales of about \$7 million in 2002. ■



PHOTO BY ROLF HAGBERG

From left, AURI's Keith Sannes and Minnesota Dehydrated Vegetable employees Jim Noyes and Monica Pendelton prepare dehydrated potatoes for shipment to food manufacturers. MDV recently added a puffed carrot, which can be rehydrated in the microwave, to its line of instant vegetables that are used in such products as soups, hashes, vegetable mixes and pet foods.

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omega compared to grain-fed beef. The ratio of omega-6 to omega-3 in grain-fed beef is about 13:1.

Source: *Progressive Farmer*, October 2002.

## Plantibodies are coming

Epicyte Pharmaceutical, Inc. was issued a patent for its "Plantibodies" technology to produce antibodies in transgenic plants.

Epicyte's technology enables the development of a broad spectrum of novel monoclonal antibodies through transgenic plants for the treatment of inflammatory and infectious diseases in humans. The patent claims any transgenic plant expressing antibodies from any animal species.

Epicyte will develop new treatments and address capacity constraints in the antibody-based therapeutics market, which is estimated to reach \$8 billion by 2004. It currently is

producing a herpes simplex virus antibody for preclinical models and a treatment for respiratory syncytial virus.

Source: Debra Robertson, executive director, intellectual property for Epicyte, (858) 554-0281, drobertson@epicyte.com, www.epicyte.com

## Wanna eat an HIV protein?

Corn genetically modified to contain a key protein found on the surface of the monkey form of HIV has been created by ProdiGene. This brings an edible, effective HIV vaccine for humans a step closer, says the National Institutes of Health. Corn-based production is touted to have several advantages, including production of large amounts of vaccine in edible form and a long shelf life.

Source: *NewScientist.com*, April 12, 2002.

## Vaccine for the runs

ProdiGene, Inc. is conducting a first clinical trial in cooperation with the National Institutes of Health, studying the safety and immunogenicity (ability to induce either humoral or cellular immunity) of an oral vaccine against traveler's diarrhea, a condition caused by *E. coli*. The vaccine is produced in corn using ProdiGene's proprietary transgenic plant technology.

Source: John McClellan, ProdiGene, (979) 690-8537.

## Protease inhibitor scaled up

ProdiGene, Inc. has begun commercial scale-up of aprotinin, a protease inhibitor used in cardiac surgery, wound healing, and pharmaceutical manufacturing. Aprotinin reduces the need for blood transfusions in patients undergoing cardiac bypass surgery. ProdiGene is producing recombinant aprotinin in corn and preclinical trials began this fall. Aprotinin is traditionally extracted from bovine lungs.

Source: www.staufferseeds.com

## Ruling against genetic drift

This fall, the FDA and USDA issued a draft guidance for plant-grown pharmaceutical production. The draft recommends pharmaceutical plants that out-cross should only be grown in regions where little or none of the plant's food/feed counterparts are grown.

The Biotechnology Industry Organization and its member companies went beyond the proposed regulation to adopt a voluntary moratorium on planting pharmaceutical and industrial crops in areas that are centers for crops prone to spreading genes — for example, transgenic corn could not be planted in the Midwestern corn belt. The intent of the moratorium and the proposed rules is to prevent the spread of exotic genes into field crops used for food or animal feed.

Source: www.bio.org ■



## CLOSE TO HOME: Food projects in Minnesota

The food industry is an ever-changing landscape, but successful products and processes can change the tastes and health of whole generations. AURI food scientists have helped farmers and small business owners develop and market dozens of products to keep profits close to home. Refining recipes and processes, scaling up, packaging, labeling and marketing are some of the ways AURI has helped new food product development such as Soup Goddess ready-to-eat soups, Black Star yogurt, Kari Lee's baking mixes, RBJ jellies, Minnesota Bison stew, Minnesota Wild jams, ForestEdge wines and others.

### Here and far away *KimVig beef*

*St. Charles, Minn.* — Cliff and Seth Kaehler found themselves and their beef cattle on the six o'clock news and the local front page after meeting with Fidel Castro during a fall 2002 trade trip to Cuba.

The boys, sons of Ralph and Filomena Kaehler, help their parents raise identity-preserved beef. The meat is marketed directly to consumers through KimVig beef, with partners David Lindevig and Dave Kimmes.

Raised in a 500-head feedlot in Cannon Falls, KimVig cattle are not fed any animal byproducts or implanted with growth hormones. Instead, through genetics, nutrition and careful handling, KimVig ensures that the meat will be tender and flavorful.

AURI has assisted KimVig with labeling, promotions, export referrals and marketing assessments.

### Cool and cleansed *Meat Processing rinse and chill technology*

*St. Paul, Minn.* — Rinse and chill technology, developed and refined over the past decade by Meat Processing Services Corporation, has seen increasing acceptance and implementation in recent years. Beef packing plants in Colorado Springs, Colo., Booker, Texas, and Geelong, Australia use the technology. It will come home to Minnesota when PM Beef Group begins using rinse and chill in its Windom plant about a year from now, says Darrell Bartholomew, AURI meat scientist.

The process flushes blood from a carcass's circulatory systems with a water-based solution that quickly chills meat. AURI tests have shown reductions in bacterial contamination and cholesterol content with the technology, Bartholomew says.

A collaborative effort between the Minnesota Beef Council, the University of Minnesota and AURI has also found that rinse and chill technology has a residual effect that helps stop harmful *E. coli* from multiplying in beef.

### Easy does it *deBarbeque pork ribs*

*Montrose, Minn.* — Smoked and seasoned, ready-to-eat pork ribs were introduced just a year ago by deBarbeque, Inc.; 500,000 pounds have already sold in Twin Cities supermarkets.

"You can throw them right on the grill" without worrying about burning the sauce or making a mess, says Dan Conroy, deBarbeque president. A 30-year veteran of the wholesale food business, he left the corporate world four

years ago and started the business with rib-smoker Gary Sterner.

Sterner, of Winsted, is carrying on his father's smokehouse tradition of more than 20 years. AURI helped to modify his recipes so the ribs could be mass-marketed, conducted shelf-life tests, developed food safety procedures and aided with the complex licensing process.

DeBarbeque's 5,000-square-foot, USDA-inspected processing plant includes computerized equipment that guides each step of production, from marinating and seasoning to the eight hours of cooking.

### No-GMO to go *Earthwise soybean snacks*

*Moorhead, Minn.* — Earthwise Processors, LLC recently received a \$150,000 USDA grant to help increase sales. The company markets identity-preserved, non-GMO and organic crops. Its Earthwise Foods brand markets roasted soybeans.

With few big elevators able to supply identity-preserved, contamination-free ag products, investor and organic farmer Lynn Brakke believes Earthwise is in the right place at the right time. Growing demand for non-GMO



PHOTO BY ROLF HAGBERG

Gary Sterner brought his father's smokehouse recipes to a new business, deBarbeque, Inc., which markets ready-to-eat ribs without sauce.

food products will also help the company, Brakke says. "No GMO crops go through our facility."

Earthwise Foods' roasted soybeans are sold to food manufacturers on the East and West Coast, and the company is actively pursuing European markets. ■

## ELSEWHERE in food products

### Ethnic and organic

Researchers at Ohio State University's South Centers at Piketon are in their first year of organically raising exotic crops such as amaranth, jute, Alaskan yard-long beans and malabar spinach. Their goal is to provide growers with alternative vegetables and cash crops that grow well in Ohio and supply growing ethnic markets.

Source: Rafic Islam, (740) 289-2071, islam.27@osu.edu

### Schwan's smart pizza

Schwan's Foodservice has introduced a soy-crust pizza for school lunch programs. Tony's SmartPizza gives students the benefits of soy protein and reduces the need for other protein and dairy products, say company officials. Schwan's is exploring an entire line of "Smart" products to help schools deliver nutritious meals.

Source: John Scroggins, (417) 875-5118; john.scroggins@noble.net, www.tonys.com, www.schwansfoodservice.com

### Asparagus salsa

Asparagus Enterprises, Inc. of DeWitt, Mich., received a \$25,000 grant to provide technical assistance for the launch of a its "Chunky Asparagus Salsa." The funds are provided via Michigan's Julian Stille Value-Added Act.

Source: www.michigan.gov/mda

### Selling fancy birds

The Nebraska Small Farms Cooperative in Pender will market value-added products including pork, emu and ostrich. It received a \$69,000 grant from the Nebraska Agricultural Opportunities and Value-Added Partnerships Act for professional services, consultation and equipment.

Another group of value-added ag producers plan to start a year-round farmers market in downtown Lincoln, using a grant from the same source to purchase equipment and get technical assistance.

Source: www.agr.state.ne.us/valueadd

### Prawns in the game

Strong demand for prawns has been noted by southern Illinois farmers. In 2001, the state had nine prawn growers on 14 acres; in 2002, there were 20 growers on 40 acres.

To raise prawns — fresh-water crustaceans resembling shrimp — farmers need a half- to one-acre pond. Start-up costs are about \$5,000 per acre annually for the first three years. Net profits ran about \$2,000 per acre last year, but profits will grow as ponds get more fertile and produce more prawns, which sell for \$8 per pound.

Source: Daniel A. Selock, Southern Illinois University

Carbondale, (618) 453-2276; siucnews@siu.edu; Laura Tiu, Ohio State University, (740) 289-2071, tiu.2@osu.edu

### Organic seal says ...

The USDA Organic Seal, part of a marketing program for organic foods, will indicate food products that are at least 95 percent organic. Products with 70 to 95 percent organic ingredients can use the word "organic" on the label but may not carry the seal.

Organic producers and handlers may tap into a \$5 million cost-share program to help pay for certification. Competitive research grants are also available through the Cooperative State Research, Education and Extension service.

For consumer information, see [www.ams.usda.gov/nop](http://www.ams.usda.gov/nop). For information on organic food and beverage exports, see USDA's Foreign Agricultural Service's organic Web site, [www.fas.usda.gov/agx/organics/organics](http://www.fas.usda.gov/agx/organics/organics) ■



# opportunities

## Farm, garden and landscape products

### Mulches, mats and fertilizers profit from ag byproducts.

BY DAN LEMKE

It's only natural that the fruits of the soil make the best materials for repairing and protecting the soil. Mulches, erosion control mats, fertilizers, and other landscaping products that incorporate ag materials such as corn stover, straw and wild rice hulls are growing in popularity with those who want to improve the environment.

"We've had a lot of interest in this area," says Alan Doering, technical services specialist at AURI's coproducts lab in Waseca. "Ag residues have good makeup for (fertilizers and mulches), plus they're abundant and economical. In most cases they have natural advantages."

Doering says AURI has worked on a number

of landscape-oriented projects and more are expected. In fact, he expects it to be a growth area because of its potential for adding value to currently low-valued products. "We are always looking to expand the use of coproducts."

Ag byproducts have natural advantages over more processed organic materials like paper. Ag products degrade more easily, release nitrogen more slowly and can usually be found in large quantities near the proposed application sites

Some of the potential landscape uses for coproducts include hydroseeding, soil amendments, erosion control mats and seed carriers. In hydroseeding, a fiber is mixed with water, seed and a tackifier to form a slurry. The soupy mixture is blown over expanses of

open ground near road or other construction sites. Once the liquid dries, the fiber forms a blanket to control erosion, hold in moisture and give the seed a welcome environment in which to grow.

Erosion-control mats serve largely the same purpose; some are impregnated with grass or other seed for even sowing. Mulches and soil amendments improve soil by adding organic material for better moisture retention and nutrients.

Highway construction and repair projects represent significant uses for erosion-control products. The Minnesota Department of Transportation has set standards for erosion-control products, such as water-holding and binding ability and more. Ag-based products often meet those requirements.

Because most useful ag materials are light and bulky, they can't be transported long distances economically. That is why there is growing emphasis on the emerging market for local fibers. With large supplies of economical raw materials, the potential exists for local businesses to emerge.

"Right now a lot of what is being used is being brought in from other states," Doering admits. "Our focus is to get these landscape products made in Minnesota because they're being used here." ■

## CLOSE TO HOME: Landscape products in Minnesota

AURI has helped to design a number of landscape-oriented projects and more are expected in the near future. Projects range from fertilizers to oil-absorbent mats; many add value to low-value commodities or crop residues.

### Optimistic for organics *Renaissance fertilizer*

*Minnetonka, Minn.* — Ask A. J. Hodges her perspective on the future of organic fertilizers, and you won't wait long for an answer.

"Our business is up 54 percent over last year and that was 30 percent higher than the year before. What does that tell you?"

Hodges is president of Renaissance Fertilizers, which produces natural fertilizers from ag products, such as soybeans and corn gluten meal, for Midwest and East Coast markets. Products designed for turf care and organic farming are finding increasing reception among consumers, Hodges says.

"People are becoming more conscious of what they are doing to the soil," she says. "They're concerned about what their children are rolling around in when they're playing in the lawn. Plus they're pleased with the results. Many say their lawns have never looked better and the products they are using are good for

the environment and good for the soil."

### Building slowly *Thrivin' fertilizer*

*Alexandria, Minn.* — Alan Zeithamer, in the organic fertilizer business for years, cautions that consumer acceptance is not a quick process. Zeithamer and his son Josh operate Bio Builder, an Alexandria-based company specializing in fertilizers for turf grass.

Zeithamer says it has taken a lot of "missionary work" to get people to try their phosphate-free Thrivin' brand fertilizer, comprised of dried distiller's grains and rough fish. Once they've tried it, the majority become repeat customers.

"A lot of consumers simply shop by way of the price tag," Zeithamer says. "We have to demonstrate to those consumers the added value that an organic product brings. It's more than just supplying the nitrogen, potassium and phosphorus."

Subtle differences need to be promoted, Zeithamer says. For example, the oil and fibers in distiller's grain supply carbon needed by soil microorganisms, which in turn are vital for nutrient transfer and disease protection. Organic nitrogen, like that found in Thrivin' products, tends to be released more slowly,



sustaining plants longer.

Zeithamer is looking to research being conducted at North Dakota State University to confirm Thrivin's lasting nitrogen release. He

hopes it will show that despite the higher price tag, organic fertilizers pay for themselves in the long run.

One niche Bio Builder has carved out is golf courses, since superintendents generally are highly educated about the added value of organic products.

"To be sustainable in the marketplace initially you need to find a niche," Zeithamer maintains. "As education continues and a greater awareness of the added value results, price won't be the determining factor."

### Soaking up opportunity *Mat Inc. fiber products*

*Floodwood, Minn.* — Nestled in the woods near Duluth is the home of Mat, Inc. This small-town business manufactures a variety of products including fibers for oil filters, a floating oil-absorbent blanket, mulches and fiber mats for reseeding and erosion control.

Company founder and president Joe Karpik uses wood or paper fiber in many applications, but has tested and sees potential for ag fibers, especially in the landscape and

**CLOSE TO HOME to next page**

## S P O T L I G H T

## Down with weeds

*Summerset markets alternative to broad-use herbicides*

BY DAN LEMKE

*Bloomington, Minn.* — AllDown Green Chemistry Herbicide, an all-natural weed control product developed by Summerset Products, is ahead of its class.

AllDown is the first and only herbicide to be listed on the approved products list by the Organic Materials Review Institute (OMRI). That approval, obtained in May 2002, makes AllDown a viable option for organic growers, for whom weed control is a constant battle.

"The OMRI listing was very important to us," says Summerset Vice President Bruce Marrs. "Without it, we would have had to get approval from a number of smaller organizations for it to be available to organic farmers. Once OMRI gives it their blessing, the others accept it, too."

AllDown is a nonselective weed and grass herbicide made from natural ingredients including acetic and citric acids, garlic and yucca extracts.

"It's a broad use herbicide — it works on broadleaf weeds, thistles, dandelions, velvetleaf and more," Marrs says. "It also works on a number of grasses like quack. It kills most of the weeds, others it browns and retards their growth for a period of time and allows a crop canopy to cover them."

### Suck 'em dry

AllDown works as a desiccant, meaning plant leaves are burned by dehydration. Research from Iowa State University shows AllDown has quick knockdown and is effective on killing whatever plant it contacts.

The formula for AllDown took more than seven years to develop, as company founder and president Paul Marrs worked with a plant scientist to reach the right mixture. The first products "ate holes through the

leaves but didn't kill the plant." Encouraged by early results, Marrs continued to do research. He finally came up with a winning combination.

Unlike its well-known synthetic counterpart, Roundup, it takes more than a few drops for AllDown to successfully kill weeds. Paul Marrs says it takes a fairly heavy coating with a spot sprayer for the herbicide to work. It is also more effective on smaller plants.

Currently, AllDown is being marketed predominantly to the Midwest farm industry. However, Summerset Products is designing a consumer retail package for the lawn and garden market. Summerset also markets organic-based, phosphate-free fertilizers, developed with AURI's assistance.

### Works in the wilderness

While organic farmers and gardeners are the market target, other opportunities are emerging for AllDown. The U.S. Fish and Wildlife Service is using AllDown in Washington and Oregon to help control noxious and invasive weed species in national parks and protected prairies.

"The government is also restricted in what they can do in certain areas," Paul Marrs says. "They can't just go in and knock a whole area down because it may contain protected or rare plants."

Marrs says AllDown's coverage requirement is about five gallons per acre, more than many traditional chemicals. But for organic farmers, government applicators or environmentally conscious homeowners, AllDown is a natural alternative with a future.

"We have a lot of hope for this product," says Paul Marrs. ■

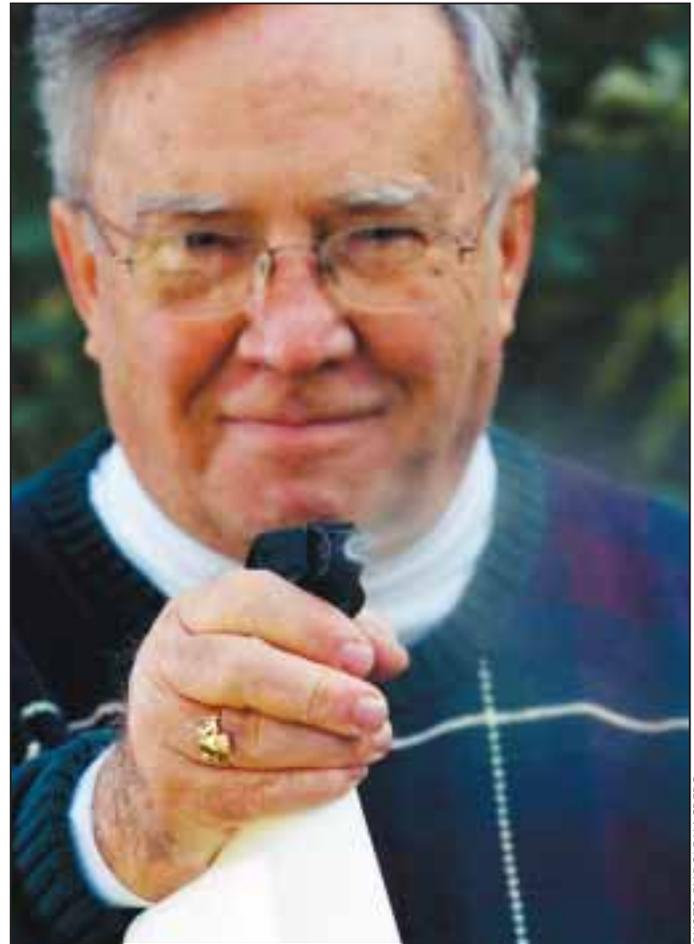


PHOTO BY ROLF HAGBERG

Paul Marrs, founder and president of Summerset Products, sprays his company's newest product, AllDown Green Chemistry Herbicide, an all-natural, broad-use weed killer.

### CLOSE TO HOME from facing page

erosion-control arenas. Karpik's business is taking over an Iowa operation that uses corn stalks for fiber blankets.

"Corn stalks should start replacing paper," Karpik says. "Paper isn't as good — it's just available. Corn has a better carbon to nitrogen ratio and contributes much more to the soil. That's what we want."

Karpik says erosion-control mats are used on road construction projects, airport runway

construction, playgrounds, lawns, golf courses or wherever fields cannot be left barren.

"You can only afford to ship so far," Karpik says, before shipping costs of the light, yet bulky materials begin to make them less affordable. However, "it would be easy to set up operations every 500 miles or so to take care of opportunities."

### Bagging the compost market

#### *Mississippi Topsoils*

*Cold Spring, Minn.* — Turning dried poultry processing waste, wood chips, leaves and

grass into quality compost doesn't just happen. It takes close monitoring of a computerized process, says Brad Matuska of Mississippi Topsoils.

The company produces Soil Essentials Premium Compost in 20-ton sealed bins. Computers control the process of mixing waste materials, maintaining optimal temperature within the bins, recycling leachate and channeling exhaust to reduce odor. After about six months, bacteria and heat transform the mixture into clean, odorless humus.

Mississippi Topsoils has the capacity to produce about 50,000 one-cubic-foot bags a year, using waste from the nearby Gold'n Plump poultry processing facility. The bagged compost is sold statewide in garden centers. Since production costs are relatively high, the compost is marketed as a premium product. "We found that price wasn't a driving force," Matuska says. "But quality is." ■

SPECIAL REPORT: OPPORTUNITIES IN VALUE-ADDED AGRICULTURE

# Crushing for cash

Farmer-owned soy processing plant going up in southern Minnesota

*Brewster, Minn.* — A new facility that will crush soybeans for meal, oil and possibly biodiesel is going up in southern Minnesota. The Minnesota Soybean Processors held a groundbreaking ceremony on the 80-acre construction site November 18.

Bob Kirchner, MSP president and Nobles County farmer, says he is happy construction is finally underway "after four years of hard work." Over \$31 million in equity was raised from more than 2,300 farmers, most from Minnesota. The crushing plant is expected to process 100,000 bushels of soybeans per day when it reaches full capacity.

"The soybeans will be grown locally, processed locally, with most of the value captured locally," says Max Norris, AURI fats and oils scientist.

"This is another opportunity for farmers to market their own crops," Kirchner says. "And the impact of this plant is going to ripple out economically ... locally and regionally. It's definitely a shot to the local economy." Kirchner expects the Minnesota Soybean Processors plant will drive up local soybean prices by about 10 cents per bushel.

While the official groundbreaking was held in November, construction actually started in late October. The plant should be operational by next November. ■

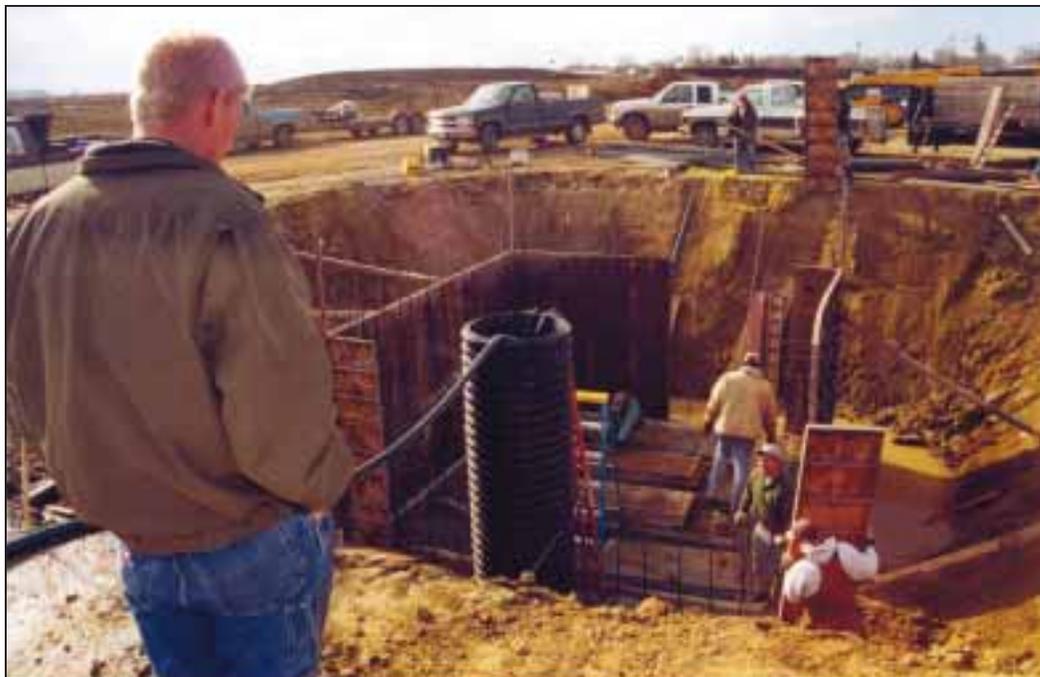


PHOTO BY DAN LEMKE

Construction is underway for a soybean plant in southern Minnesota that may produce biodiesel as well as crush soybeans for meal and oil. Looking on is Tyler Freeman, plant operations coordinator.