futures

MICHIGAN
AGRICULTURAL
EXPERIMENT
STATION

Fall 2004
Vol. 22 No. 3

Enhancing Profitability in Agriculture and Natural Resources

looking into futures

Enhancing Profitability in Agriculture and Natural Resources

As one of the state's largest industries, agriculture contributes about $37 billion annually to Michigan's economy and employs about 500,000 people. Michigan is second only to California in the diverse array of crops grown and the state is the top producer of 11 commodities.

Tourism, though a smaller industry, adds about $15 billion each year and employs about 160,000 people. Much of the state's tourism revolves around Michigan's stunning natural resources — the Great Lakes, miles of streams and rivers, and acres of forests, wetlands and other natural areas.

The challenges facing Michigan agriculture and natural resources are increasingly complex and diverse. In this issue of *Futures*, we highlight just a portion of the research the MAES is supporting to enhance the profitability of agriculture and natural resources industries. This includes basic research in both the plant and animal sciences to improve disease resistance and reduce dependency on chemicals, as well as research to identify and develop value-added opportunities for agriculture and natural resources producers in the state.

When Project GREEEN — Generating Research and Extension to meet Economic and Environmental Needs — was conceived in 1995, its goal was to make Michigan agricultural more competitive. Today, nearly 10 years after its inception, nearly everyone involved hails the state's plant initiative as a model of successful cooperation between the MAES, MSU Extension, the Michigan Department of Agriculture, Michigan Farm Bureau, and Michigan plant-based commodities and industries. By finding rapid, integrated ways to address insect, disease, weather, regulatory and economic factors to benefit everyone involved with plant agriculture, Project GREEEN has helped the agriculture industry, the economy and the environment.

Other MAES research focuses specifically on the Michigan wine industry. Once seen as far behind California (never mind France) in product and production, Michigan wines are now internationally recognized. The number of wineries in the state has doubled in the past 10 years, and acreage and value of the industry have increased tremendously. Nearly every county along the Lake Michigan shoreline is home to a winery; in addition to agriculture, the wineries give a boost to tourism with bed and breakfast inns, restaurants and recreation such as horseback riding on site.

Animal agriculture and its associated products — milk, meat, wool, eggs, cheese and butter — account for a significant portion of Michigan's economy. MAES research on new methods to combat diseases; selecting cows with desirable traits such as high milk production, high fertility and longevity in the herd; and new ways to add value to the raw products, such as new types of dairy or meat products, is helping to improve productivity for the state's animal producers.

Serving as a one-stop shop for agricultural and natural resources entrepreneurs, the MSU Product Center for Agriculture and Natural Resources helps clients nurture their ideas for businesses, products or services, and turn them into profitable operations. Supported in part by the MAES, the Product Center connects its clients with Michigan State's vast array of knowledge and expertise and helps business dreams turn into reality.

We hope you enjoy this issue of *Futures* and that it helps you understand more about the MAES and the research it funds. If you have comments or questions or would like to subscribe to *Futures* (it's free!), send correspondence to *Futures* Editor, 109 Agriculture Hall, Michigan State University, East Lansing, MI 48824-1039, or send an e-mail to depolo@msu.edu.

For the most current information about the MAES, I invite you to subscribe to the free MAES e-mail newsletter. Sign up by visiting the MAES Web site at www.maes.msu.edu/news.htm. Scroll to the bottom of the page and complete the subscription form.

For his gracious assistance with the cover photograph, I would like to thank Ben Darling, assistant director of the MSU Land Management Office.

::: Jamie DePolo

futures

MICHIGAN AGRICULTURAL EXPERIMENT STATION ::: Fall 2004 Vol. 22 No.3

All photography by Kurt Stepnitz, University Relations photographer, except where noted.

Cover photoilllustration by Christine Altese.

Jamie DePolo, *Editor*
Christine Altese, *Art Director*
Gary Lemme, *Associate Director*
Doreen Woodward, *Assistant Director*
Geoff Koch, *Writer*

Futures is published quarterly by the Michigan Agricultural Experiment Station. To receive *Futures* free of charge write to *Futures* Editor, 109 Agriculture Hall, MSU, East Lansing, MI 48824, or call (517) 355-0123.

Making Business Dreams

The MSU Product Center for Agriculture and Natural Resources helps clients nurture their ideas for businesses, products or services and turn them into profitable operations.

The MSU Product Center for Agriculture and Natural Resources began as a gleam in Chris Peterson's eye in 1998. An MAES agricultural economics researcher who holds the Homer Nowlin Chair for Consumer-Responsive Agriculture, Peterson is known for his research on agribusiness, marketing and strategic management.

"At the end of 1998, I wrote a proposal for Project GREEEN [Generating Research and Extension to meet Economic and Environmental Needs, the Michigan Plant Initiative] funding that called for doing a series of studies on how best to position plant agriculture in the food system, with an eye toward value-added and specialty goods," he recalled. "Agriculture is the second largest industry in the state, but many rural areas continue to be economically depressed. Productive farmland is being converted to non-agricultural use. Converting agribusiness from a commodity orientation [selling dry beans to a processor, for example] to a differentiated product orientation [producing a value-added bean dip from the beans and keeping the processing money in the state, for example] will help revitalize Michigan agriculture."

The proposal wasn't funded, but it was highly rated.

"Ian [Gray, former MAES director] proposed that we think of it as a futuring center," Peterson said.

He and his colleagues wrote and rewrote planning documents and budgets as the project kept evolving. In February 2003, Gray; Maggie Bethel, MSU Extension (MSUE) director; and Jeff

a Reality

Armstrong, dean of the College of Agriculture and Natural Resources, signed a memorandum of agreement to fund the MSU Product Center for Agriculture and Natural Resources for five years and named Peterson its director.

The center's goal is to improve economic opportunities in the Michigan agriculture, food and natural resource sectors, and its experts are available to assist fledgling entrepreneurs and established companies. Acting as a single doorway to Michigan State's vast collection of knowledge and expertise, the center helps guide clients through the phases of conceptualizing, planning and actually starting a business.

"There are a lot of ideas that should be abandoned early," Peterson said, "because they're not going to be successful. Many times people just aren't aware of everything that is involved with creating a new product. Our counselors help clients come to grips with the realities of product development and marketing. Then the client makes the decision to go forward or not."

Peterson said the center views a decision to halt the process just as successful as one that goes forward.

"Otherwise a lot of time, money and effort are wasted on something that isn't going to work," he explained. "Avoiding those losses is a good business decision."

"About 90 percent of new businesses fail," added Tom Kalchik, associate director of the center. "We want to help people do better planning so more of them are successful."

In addition to assisting clients with business planning — carried out in the client services part of the Product Center — the center also assists clients with strategic marketing and trains them in entrepreneurship.

The Strategic Marketing Institute does market research and writes reports and working papers that Product Center clients can use when evaluating the uniqueness or marketability of their products. Some reports are written because clients request the information; others are written because the researchers, led by William Knudson, product market economist for the center, are being proactive and seeking new markets for Michigan products. Recent reports include "The Market for Organic and Fortified Eggs," "The Edamame Market," "The Pet Food Market" and "Spending on Food: Implications for Michigan Agriculture."

The most recent component of the Product Center, the Innovation Academy, provides executive

Chris Peterson, Dianne Novak and Tom Kalchik *(left to right)* help clients start or expand their businesses in the MSU Product Center for Agriculture and Natural Resources.

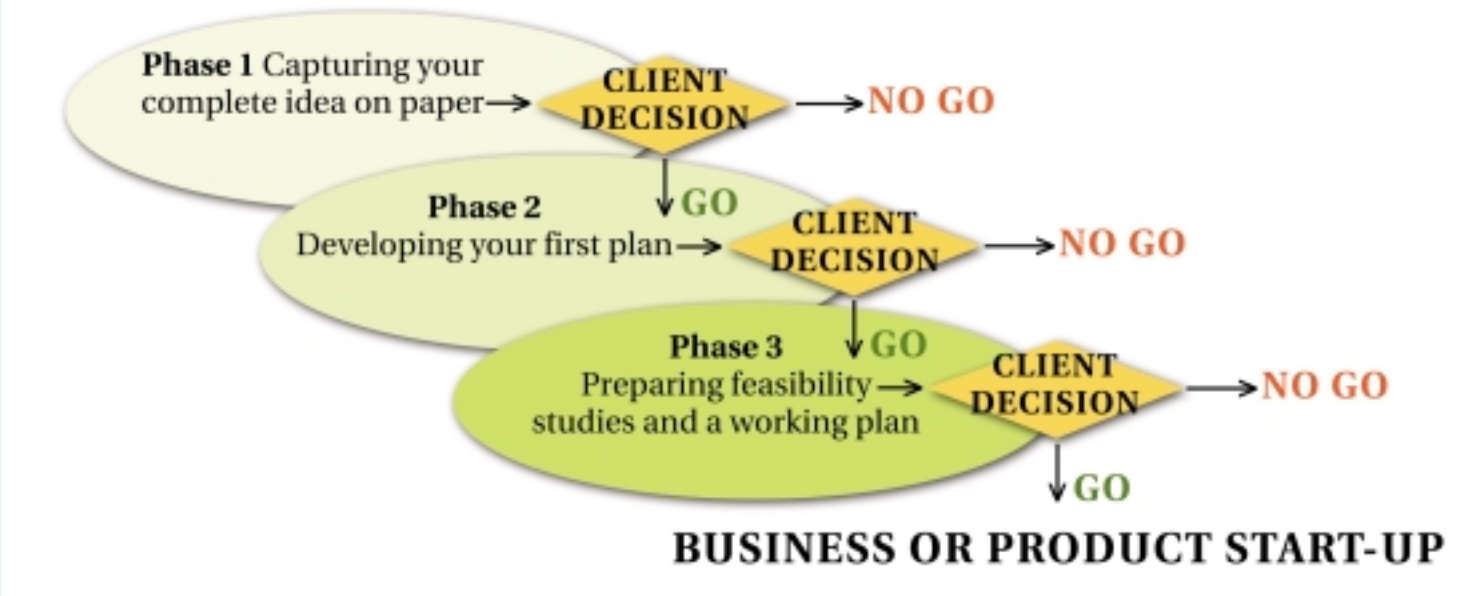
leadership education for entrepreneurs and those wishing to be entrepreneurs through classes and in-service and mentoring programs. Barb Fails, associate professor of horticulture, has been tapped to oversee the academy.

"Executive leadership education is about training people to be entrepreneurs," Peterson explained. "We have to build a pipeline of entrepreneurs; it's not good to have ideas without a person to make them a reality. It's also good to have people understand what it takes to be an entrepreneur. It is critical that this is part of the Product Center."

Kalchik and Novak estimated that about 80 percent of the prospective clients can't write down their ideas and decide to hold off on pursuing their business ideas. Which, as Peterson explained, is still a success because no money or additional time is spent on an unpromising concept.

"For those that can write things down, we connect them with one of the center's network of innovation counselors," Kalchik explained. "We try to connect a client with a counselor who is geographically close or has expertise in the type of business or product in which the client is interested."

There are currently 28 innovation counselors in



The Product Center uses a three-phase process to help its clients start their businesses. After each phase, the client decides whether to move forward.

the state, most of them MSUE county agents who have taken special entrepreneurship training and have entrepreneurial experience and are devoting a portion of their time to work with center clients.

The counselor and the client review the written business idea and the counselor helps finalize the concept, narrow the focus and identify a market for the product or service.

"A counselor asks a client a number of questions to refine and define the concept," Kalchik said. "Why is this product unique? Why would people be interested in it? Where is the funding coming from and how much money do you need? Who are your competitors? How will the product be marketed? The answers to all these questions form the outline for the client's business plan."

So You Want to Start a Business....

Clients find the Product Center through a variety of routes — MSUE contacts, the center's Web site or referrals from MSU experts. Once contact is made, center staff members begin a three-phase process with clients that lead them through developing an initial business concept to making the final decision about start-up.

"When people first call or visit us, we discuss their ideas and have them write down their ideas as completely as they can," said Dianne Novak, project services coordinator at the center. "Sometimes people have a hard time articulating what they want to do or need, so writing everything down is a good first step. Then we all have the same information."

"Sometimes people have a hard time articulating what they want to do or need, so writing everything down is a good first step."

This is phase 1 of the center's three-phase process. These services are provided to clients at no charge. As clients move on through the process and become more serious about their start-up, fees are charged.

"We have a commitment form that we ask clients to fill out," Novak said. "We ask them to commit to spending $500 to $2,000 on education and resources to complete their business plan. Sometimes we introduce clients to private consultants — those costs are negotiated between the client and the consultant."

"We are also aware that confidentiality is important to our clients," Kalchik said. "We worked with the MSU Office of Intellectual Property to develop a confidentiality agreement for our clients."

For phase 2, the center prefers that its clients take a 10-week entrepreneurship training course called NxLevel. The cost is $250, but grant money is available for those who may not be able to afford it.

"It's a business plan class," Novak explained. "We encourage our clients to take the class, but we also have workbooks and computer programs that clients can use at home if they are unable to attend the class."

"At the end of the class the clients have a basic business plan," Kalchik said. "It's been honed and critiqued. At this point, we set up meetings for our clients with professional consultants or MSU experts who can help them with their specific needs."

"When their business plan comes out of the class, it's usually very strong, but there may be one or two questions," Novak added. "The clients have very specialized requests for information, such as a recipe for dough or information on advertising. I try to link them to MSU expertise in these areas. Being in the College of Agriculture and Natural Resources has been very helpful; everyone has been very generous with their time and expertise."

Novak maintains and builds contacts throughout MSU, however, to ensure that center clients have access to all the assistance they need.

"All the faculty members involved have been thrilled to help," Peterson added. "We've received positive responses from everyone we've contacted."

Product Center staff members and counselors also have access to reports produced by the Mintel International Group. These reports detail consumer preferences and demographics and provide other market research for all major consumer goods categories in the United States. Center staff members also use the Mintel Global New Products Database to track product launches. For example, Novak said, if another company has just launched a blueberry-flavored soda pop, which is the product one of her clients is working on, she can quickly alert her client.

When the initial business plan is finalized, the client again makes the decision to move forward or stop. If going ahead, phase 3 consists of feasibility studies and evaluation, then start-up if the first two components are successful. On average, according to Kalchik, most clients take about two years to move through the center's three phases.

"But it depends on the product and where the client is in planning. If they come to us with a strong business plan and just need some specialized help, it can be a shorter process," he said.

In its first year, the Product Center has assisted 80 clients in some way, and center staff members are watching several begin operations as 2004 winds down. The Chene-Ferry Farmers Market, in Detroit, and DaisyDell Farm and Market, in St. Johns, are two of the first clients to open their doors for business.

Revitalizing Agriculture, Revitalizing Detroit

On the corner of Chene and Ferry, in the east side of Detroit, about a quarter mile away from the General Motors Poletown Plant, an agricultural revolution is quietly taking place. What was once a derelict, long-closed farmers-market-turned-recy-

The Product Center is assisting the Michigan Coalition of Black Farmers to open the new Chene-Ferry Farmers Market in Detroit. In the photo at right, Mike Score *(far right)*, MSUE agricultural agent in Washtenaw County, who also serves as an innovation counselor for the Product Center, discusses plans for the market with *(right to left)* Fontaine Sheffey, Ralph King, Rich Hall (in hat) and Herman McCord, all of the MCBF. Score also serves as an adviser to the Chene-Ferry Market Board of Directors and works with the group to resolve any issues that come up.

cling-center has been refurbished and is starting to return to its former self — a lively farmers market, offering neighborhood residents a place to meet, buy fresh produce and plants, and reconnect with Michigan's agricultural heritage.

The culmination of years of work by the Detroit-based Michigan Coalition of Black Farmers (MCBF), the new Chene-Ferry Farmers Market opened in September and ultimately aims to feature fruits, vegetables and horticultural products from growers in Washtenaw and Lenawee counties at 40 vendor stalls.

"Henry Reed, the president of the MCBF, felt that this community needed a community-based group to bring food to the community," said Ralph King, executive director of the MCBF and long-time associate of Reed's. "Besides providing fresh food, the market is also an opportunity to educate people about agriculture, health and nutrition, as well as enlighten them about all the jobs involved in agriculture — trucking, storage, packaging, retailing. Agriculture is not just about the food delivery system — it has a role in many jobs and careers. If the market is successful, I think it can lead a renaissance in the area."

Reed started the MCBF 14 years ago to advocate for Michigan agriculture and expand agriculture's ability to meet the needs of urban communities by linking urban consumers with rural producers. One need not be a farmer to join.

Opened in 1929, the original Chene-Ferry Farmers Market was a fixture for more than 40 years in the blue-collar Polish neighborhood that surrounded it. The market closed in the 1970s and the building was used as a recycling collection center until it closed for good in 1988. When the Poletown Plant opened in 1981, many residents had to move to make way for the construction and the neighborhood gradually deteriorated. Until now, the community's only source for groceries within a seven-mile radius was a convenience store near the market.

"The city of Detroit has four major chain grocery stores to serve the entire population," King said. "There is a coalition of independent grocery stores. But when we were doing research on marketing the market, we found there was a lot of food insecurity."

The Wayne County MSUE office has no agricultural agent. But Reed had heard good things about the work of Mike Score, Washtenaw County MSUE agricultural agent, who is also an innovation counselor with the MSU Product Center. (Score's grandparents grew up near the market.) Once the connection was made, the project took off.

> "We want to help people do better planning so more of them are successful."

"Hank Reed had heard of my work and asked me to help them," Score recalled. "I introduced them to the Product Center and walked them through the process of writing a business plan."

Score also serves as an adviser to the Chene-Ferry Market Board of Directors and works with the group to resolve any issues that arise, such as applying for zoning variances. Score also helped the MCBF connect with some of the farmers who are providing the produce that the market is selling, as well as offering entrepreneurship classes and training the market's vendors.

"Whenever they hit a barrier, I encourage them, keep them focused and help them come up with solutions," Score said.

"Working with MSU has been a boon for us," King said. "It's been a great opportunity to work with Mike Score and Tom Kalchik. They gave us the confidence to move forward and commit to this project. I doubt we could have done it without them. MSU has been a valuable partner to us. I give all the kudos in the world to the MSU Product Center."

Fulfilling a Dairy Product Dream

Rick Batora and his wife, Karen, both come from dairy backgrounds and are still part of her family's 4,000-cow operation. (Karen is the daughter of Duane Green, and their multigenerational family farm, Green Meadow Farms, just south of Elsie, is one of Michigan's largest dairy operations.) Rick and Karen wanted to take the next step in dairy

Rick and Karen Batora *(left)* took the next step in dairy farming and opened their own market, DaisyDell Farm and Market, in June 2004. The market sells cheese, ice cream and other dairy products, and also offers visitors a chance to learn about the dairy industry.

farming and open their own market to sell cheese, ice cream and other dairy products, as well as offer visitors a chance to see how food is made and learn about the dairy industry.

"The rest of the family didn't want to go in that direction, so we decided to do it on our own," Rick explained.

On June 28, after assistance from the MSU Product Center, the Batoras realized their vision and opened the DaisyDell Farm and Market in St. Johns. The market sells farmstead cheeses and ice cream and includes a deli and café with a bakery that sells coffee, soups and sandwiches.

"We're focused on dairy products," Rick explained. "Our cheeses are made by farmers or come from places where the farmer has control of the raw product. All our milk and ice cream are made from BST-free cows."

Next spring the Batoras plan to build a cheese processing plant and begin making their own cheeses. The DaisyDell owner-managers also plan to add their own cows to the operation next year and offer visitors a chance to get up close and personal with the animals in a petting zoo.

The Batoras, MSU alumni, were atypical Product Center clients because they had already written their business plan when they met with center staff members for the first time.

"Karen was taking an MSUE entrepreneurship class in Clinton County," Rick said. "In the class, she heard about the MSU Product Center. We had already written a first draft of our marketing and business plan, but Marilyn Thelen [agriculture and natural resources MSUE agent in Clinton County, who also works as a Product Center counselor] helped us go through our plan and get more information and find the avenues to finish it."

The Product Center also connected the Batoras with John Partridge, MSU associate professor of food science, who specializes in dairy product development.

"Dr. Partridge was very helpful," Rick said. "He advised us on the type and size of equipment needed for an operation our size. He was a super guy and offered to help us at any time. He told us that when we were ready to make new cheeses, he was available to help us. We have an on-going relationship with him and it's been great.

"The MSU Product Center has helped us a lot," he continued. "They have more resources now than when they first started — we kind of grew up together. Karen took the entrepreneurship class in January 2004 and the center was starting to help clients. We've benefited from its new resources."

Thelen now is helping the Batoras make connections in the MSU Department of Advertising for advice on getting the word out about the market and all its offerings.

"Our passion is agriculture education," Rick said. "We want to present agriculture in a positive manner and show people where their food comes from. It used to be that your grandpa had a farm and kids would visit and learn about agriculture. Now most people live in the city and have never touched a cow. As school starts, we plan to do open houses and education classes for elementary school kids to show them how ice cream, butter and cheese are made."

::: Jamie DePolo

> "Working with MSU has been a boon for us. They gave us the confidence to move forward and commit to this project."

A GREENER michigan

Almost 10 years after its initiation, Project GREEEN — Generating Research and Extension to meet Economic and Environmental Needs — has improved Michigan's plant agriculture industries, the economy and the environment.

In 1995, a group of Michigan agricultural leaders sat down together at the Ag Summit meeting to discuss how Michigan plant agriculture could be more competitive. At the table were Ben Kudwa, executive director of the Michigan Potato Commission (MPC); Harry Foster, then executive director of the Michigan Plum and Asparagus advisory boards; Mark Arney, then executive director of the Michigan Apple Committee; Fred Poston, then dean of the MSU College of Agriculture and Natural Resources; Bob Gast, then director of the MAES; and Phil Korson, president of the Cherry Marketing Institute (CMI). Though Michigan has one of the most diverse agricultural industries in the country — second only to California in number of crops produced — the state's producers were having difficulty keeping up with growers in other states in quantity and cost of products.

"Project GREEEN, then called the Plant Initiative, was a combination of a number of ideas that people had," said Ben Kudwa, who continues to serve as executive director of MPC and is also executive director of the Michigan Carrot Committee. "Plant agriculture was viewed as underserved, especially with regard to emerging and emergency issues. The idea was to find a source of funding for research to address these issues."

In 1995, Korson, who remains president of CMI, also was chairman of the board of the Michigan Integrated Pest Management (IPM) Alliance.

"The idea started there," he explained. "We were discussing issues affecting Michigan agriculture and we came up with the concept. It was a little narrow at first, however; we knew we needed to create a broad coalition to be successful."

Soon after the Ag Summit meeting, and with the support of a broad plant industry coalition and the Michigan Department of Agriculture (MDA), Project GREEEN became a reality. Modeled after the Michigan Animal Industry Initiative, Project GREEEN is a cooperative effort between plant-based commodities and businesses together with the Michigan Agricultural Experiment Station (MAES), Michigan State University Extension (MSUE), the MDA and Michigan Farm Bureau (MFB) to advance Michigan's economy through its plant-based agriculture. Its mission is to develop research and educational programs, ensure and improve food safety, and protect and preserve the quality of the environment.

The combination of agricultural production and food processing represents the second largest industry in Michigan, contributing more than $40 billion to Michigan's economy annually. Michigan leads the nation in the production of 10 crops and ranks fifth or higher in 32 crops, according to figures from 2002. Plant-based agriculture — fruit, vegetables, turf, floriculture, woody ornamentals, field crops — contributed more than $21 billion to the state's economy and generated nearly 75,000 jobs in 2000. If retail values of the net share of Michigan's food and ornamental supply are tabulated, the plant sector adds thousands more jobs and several more billion dollars to the economy.

Ben Kudwa, executive director of the Michigan Potato Industry Commission and the Michigan Carrot Committee, was one of the original planners of Project GREEEN. He gives the program high marks.

Michigan has the potential to grow an even wider variety of crops, as long as producers receive the necessary research and technological information. Likewise, processors fill unique market niches but need research on new products, ingredients and processes to thrive.

Project GREEEN strives to find rapid, integrated ways to address insect, disease, weather, regulatory and economic factors to benefit everyone involved with plant agriculture, from producer to processor to consumer. Research projects follow a competitive cycle that begins with each plant commodity group identifying time-sensitive industry priorities.

Researchers draft their proposals in response to these needs in one of four program areas: basic research, applied research, value-added research or extension/demonstration/education. A review panel consisting of MAES researchers, MSUE agents, and MDA, MFB and commodity representatives meet to decide which proposals should be

Sugar beets are just one commodity that has been significantly helped by Project GREEEN research and education.

funded and present their recommendations to the Director's Action Team (DAT). The DAT then uses these recommendations to make final funding decisions across the spectrum of Michigan's plant agriculture industries.

Project GREEEN has set a standard for integrated plant agriculture research because it has the ability to solve grower and processor problems rapidly and allow plant agriculture and processing industries to reach their potential.

"GREEEN is an outstanding initiative," said Keith Creagh, MDA deputy director and member of the DAT. "It functions the way the industry leaders that designed it wanted it to function. The industry gets to set priorities and have input that helps direct university research."

Phil Korson, president of the Cherry Marketing Institute, also helped with initial planning for Project GREEEN. He says GREEEN is a model program.

"GREEEN is unique and a model for a lot of people to follow," Korson added. "I view our relationship with MSU as a partnership. Research is a key piece of the cherry industry's success, whether the research is on production techniques or on the health benefits of cherries. I can't say enough positive things about Project GREEEN — it's a great partnership. Everyone involved has won. It's a win-win situation."

"One of the strengths of Project GREEEN is the university leadership's willingness to break down the department walls and get researchers from different disciplines talking to each other about how to solve a problem," said Bob Boehm, manager of the Commodity and Marketing Department at Michigan Farm Bureau, who also is a member of the Plant Coalition. "Making the diversity of the researchers involved in a project one of the criteria for funding has been excellent for Michigan agriculture."

"I rank GREEEN very highly," Kudwa said. "It's the best initiative to come along and has helped a lot of commodities. It's important that industry helps determine the research priorities."

According to Kudwa, Korson, Boehm and Creagh, GREEEN's uniqueness is a product of its flexibility. Each year, each plant commodity group is asked to submit its list of research priorities. So if a new pest or disease has become an issue in the past 12 months, GREEEN has the ability to fund research to address the problem quickly.

"GREEEN is successful in responding to the emergencies of the day," Creagh said. "From the emerald ash borer to water use to phytophthora to value-added products, GREEEN has responded. Usually programs have money to hire people and put up buildings, but with GREEEN the money was specifically for projects. It gives GREEEN a flexibility that other programs don't have.

"GREEEN engages people," Creagh continued. There is enough money there to tweak their interest and get them working on a project that may be slightly outside their main research focus."

Project GREEEN also responds to unexpected plant industry challenges. For example in 2002, the Michigan cherry industry experienced the smallest crop in its history because of low early spring temperatures followed by several devastating frosts. The resulting economic hardship for many of the state's growers limited the amount of dollars available from grower organizations to fund research projects. Project GREEEN played a key role in assisting the Michigan cherry industry in funding its highest research priorities during this difficult year.

"We couldn't anticipate the 2004 problems in 1995," said Boehm. "The ability for commodity groups to have input every year is very important. Project GREEEN also allows MSU administrators to retain some funding each year to respond to issues that may arise as a result of weather or other events that happen during the year. These problems may not have been pressing when the industry submitted their priorities but evolved over the growing season. This ability to respond almost instantly has been key to GREEEN's success."

"If industry needs change, GREEEN can change,"

Korson said. "It's very nimble in its response to issues."

Korson also cited MSU's land-grant tradition as part of the program's success.

"Michigan agriculture has a unique relationship with state government and our land-grant university," he said. "We have created a special partnership here. When I visit other states, the growers and the university researchers are not on the same page. In Michigan, I am very comfortable having an MSU researcher represent growers on a committee. The scientists are very tuned in and understand what growers need and want."

"The reason the program is so successful is the leadership in GREEEN and at the university," Creagh said. "Hats off to Ian [Gray, former director of the MAES] and Maggie [Bethel, director of MSUE] for providing excellent direction to the program."

"Ian has never wavered from the original mission of Project GREEEN," Korson added. "Because of this, it has tremendous support across the industry."

In fiscal year 2003, Project GREEEN awarded approximately $1.1 million to 36 new research projects. Another $900,000 was directed toward multi-year projects that started in 2001 or 2002 targeting priority issues affecting Michigan's plant agriculture industries. Following are two examples of GREEEN-funded research projects that have made a difference for Michigan agriculture.

A Strawberry Success Story

About 1,000 acres of strawberries are grown each year in Michigan, mostly at U-pick farms or at farms that supply roadside produce stands and local farm markets. At a value of $3.8 million, strawberries are a small but important component of the total Michigan agricultural economy. All strawberry varieties are susceptible to black root rot disease, which is caused by a complex of soil-borne fungi and nematodes. The disease has been found in all strawberry-growing regions of the United States and can reduce yields by almost 50 percent if growers do not fumigate the soil to control it.

"Black root rot is the primary cause of yield reduction in Michigan strawberries," said MAES horticulture scientist Jim Hancock. "It's a complex disease that involves nematodes and at least two fungi all working together to compromise the plant and causing it to grow poorly. The pests wait in the soil for the next planting season and then attack the next crop. They can also be brought in on the roots of field-dug transplants."

Hancock and MAES plant pathology scientist Annemiek Schilder have teamed up on a many-pronged approach to combat black root rot. Their initial research project was funded by Project GREEEN and has snowballed into a much larger effort, bringing in researchers from the U.S. Department of Agriculture in Beltsville, Md., and from Cornell University in New York.

Keith Creagh, deputy director of the Michigan Department of Agriculture, serves on the GREEEN Director's Action Team. He says GREEEN is an outstanding initiative.

Methyl bromide is the most commonly used pesticide to control black root rot; however, the Food Quality Protection Act (FQPA) of 1996 has

Bob Boehm, manager of the Commodity and Marketing Department at Michigan Farm Bureau, believes that cross-disciplinary research teams are one of GREEEN's strengths.

MAES small fruit breeder Jim Hancock (left) is trying to breed more resistance to black root rot into strawberries. Grad student Chrislyn Drake is also working on the project.

called for withdrawal of methyl bromide on the following schedule: 25 percent reduction in 1999, 25 percent reduction in 2001, 20 percent reduction in 2003, and complete phase-out in 2005.

"Methyl bromide is really on its way out," Hancock explained. "California and Florida [the country's two biggest strawberry growers] are focusing on chemical alternatives to methyl bromide, such as methyl iodide, which will probably be expensive. We want to develop a more holistic, multifaceted approach that includes looking for disease resistance in wild strawberry varieties and then breeding that resistance into the popular varieties."

Hancock and Schilder's approach is also better for Michigan growers. Michigan grows strawberries in a perennial system, which means the same plants are left in the field after harvest. So plants damaged by black root rot one year carry this damage into the next season and the disease can build up over several seasons. In California, the plants are grown in an annual system, which means the plants are replaced each year after harvest. California also grows a limited number of strawberry varieties, while Michigan and the Northeast in general grow a number of diverse varieties. California's strawberry growing techniques are also different than those used in Michigan.

Hancock, a small fruit breeder, and his students Chad Osborn and Chrislyn Drake screened traditionally grown varieties of strawberries as well as some wild species and found levels of resistance to black root rot in a number of them. His long-term project is to breed higher levels of resistance into the varieties of strawberries grown in Michigan.

"But this is difficult to do," he explained. "We can raise the level of resistance in certain varieties, but we'll probably never develop a completely resistant variety. We can possibly have some improved varieties to recommend to growers in eight years. So we decided to add cultural modifications to the project."

Which is where Schilder comes in. A plant pathologist who specializes in diseases of small fruits, Schilder and postdoctoral researchers Rabiu Olatinwo and Siva Sabaratnam began studying using compost and biological controls to manage black root rot.

"We also teamed up with researchers in Beltsville and at Cornell who are studying using rotation crops and composts for black root rot control," she explained. "We have test plots in a number of locations around the Northeast."

The research team has had some success in controlling the disease by adding compost to the soil, but results varied. In some cases, the compost was actually detrimental to the plants.

"GrowSoxx," a method to deliver compost to strawberry plants, was developed by Patricia Miller, a USDA scientist. Miller is collaborating with Jim Hancock and Annemiek Schilder to combat black root rot.

"Compost generally improves soil quality, but applying sufficient amounts of mature compost to the strawberry fields is difficult and expensive," she said. "Its effectiveness also seems to depend on the severity of the disease and the type of compost that is used."

One of the team members at the USDA in Beltsville, Patricia Milner, is doing research on a compost recipe and application method that can be

adapted to various areas of the country. She has developed a delivery technique called "GrowSoxx" that uses long sleeves to keep the compost together and contained near the plants. Test plots using GrowSoxx in Maryland look promising.

"Planting cover crops such as kale, sweet corn and rye in the field after the strawberries are harvested also shows some promise," Schilder continued. "Rotating out of strawberries reduces the number of pathogens in the soil."

Schilder's research group also has evaluated many commercially available and some experimental biocontrol products for their ability to control black root rot. These products contain beneficial microbes that help the plants fight the disease. Most are not labeled for use in strawberries but may be in the future. In her field trials some biocontrols were detrimental to the strawberry plants, while others looked quite promising. One of the most successful was isolated from strawberry plant roots in a Michigan field.

"We have investigated each component individually," Hancock explained. "I don't think any single one will solve the problem. We need to find the best ones from each area and then develop a system integrating them into a combination system that works for our growers."

"In the Northeast, we all use the same cultivation techniques for strawberries," Hancock said. "Our production isn't as large as California's, but we have many more growers than California. This work has the potential to help a lot of people."

"We want to create an environmentally friendly crop system for strawberries with minimal inputs," Schilder added. "Strawberries are difficult to grow without pesticides, but the chemicals are expensive to apply and their benefits diminish over time."

The scientists hope that raising the levels of black root rot resistance through breeding will improve yields by 20 percent, and that the other management techniques — cover crops, biocontrols and compost — will each add an additional 10 percent, all of which will combine to offset the 50 percent reduction in yield attributed to black root rot. These techniques form the foundation of a cultural system with many fewer chemical inputs.

Similar diseases affect other crops, and the methods Hancock and Schilder are studying may have applications for them as well.

"I think this is an excellent example of a GREEEN success story," Hancock said. "We don't have complete results yet, but with our three-year grant from GREEEN, we did some basic research and used those results to get three federally funded grants for almost $1 million. And we'll be helping a large number of people."

The Sweet Smell of Sugar Beet Production Success

Michigan is the country's fourth largest producer of sugar beets. Its 2002 harvest of 3.2 million tons was almost 12 percent of the U.S. total. Most of the crop is grown in the Thumb region of the state, and Huron and Tuscola counties were the state's top two producers in 2002. Almost all of the beets harvested

MAES plant pathologist Annemiek Schilder is studying using compost and biological controls to manage black root rot in strawberries.

are processed into sugar; Monitor and Michigan Sugar are the two biggest refining companies in the state. Monitor produces Big Chief sugar, and Michigan Sugar produces Pioneer sugar. Sugar beets are an integral part of Michigan's economy, adding more than $111 million in 2002.

But in 1997, the picture was not so sweet. In 1984, sugar beet yields took a nosedive and continued to plummet each successive year. Acreage planted dropped dramatically, and growers started to consider planting other crops.

"The industry was at risk of going out of business," said Steve Poindexter, MSUE sugar beet agent based at the Saginaw County MSUE office. "October through March is when the sugar refining

factories normally operate, but some were shutting down in early February because there weren't any beets to process."

Clearly, something needed to be done. So the MAES and MSUE convened a meeting of growers, processors, researchers and educators to discuss the problems and formulate solutions. The group developed a list of 30 items that were issues for the sugar beet industry, and the growers and processing companies offered to pay half the salary of an MSUE agent to focus exclusively on sugar beets. In the fall of 1997, the Sugarbeet Advancement Committee was formed and Poindexter was hired as the first MSUE sugar beet agent.

"Production was an issue," Poindexter explained. "We needed research on new cultural techniques, varieties and pest control."

Crown rot, caused by the fungus *Rhizoctonia*, is a problem for many sugar beet growers in Michigan. Research funded by GREEEN has helped fight the problem.

A cooperative partnership between MSU, the sugar processing companies and growers, the Sugarbeet Advancement Program is funded through fees assessed to sugar beet producers. In 1999, the Sugarbeet Advancement Program, with Poindexter as the coordinator, put together an integrated team of MSU scientists, many affiliated with the MAES, and received a three-year grant from Project GREEEN to study improving plant emergence, persistence and yield of sugar beets in Michigan, all research priorities identified by the industry.

"The research results have been used extremely successfully in the growers' fields," Poindexter said. "Sugar beet acreage is up, yields are up and recoverable white sugar per acre is also up. We're more productive than we were in 1982. Things are going so well that the growers bought Michigan Sugar — it's a grower-owned cooperative now."

According to Poindexter, a big part of the reason for the project's success is the on-farm nature of the research plots.

"Almost all the research is done in growers' fields, using their equipment and their systems," he explained. "These research trials are larger than the typical small plots done on campus or in labs. The growers like it — when the research is in their fields and experiencing the same conditions their crop is, they have more faith in the results."

"The research is done just like a grower would produce beets," said Gene Meylan, a producer in Saginaw who has been growing sugar beets for 34 years and is also the president of the Monitor Sugar growers. "We really appreciate this. You can see all the variables and know that the research was done under the same conditions you're growing your beets under. This research is very valuable — it's what is taking us forward as an industry."

"Before the Sugarbeet Advancement Program research, the companies always did their own basic research," added John Spero, a sugar beet grower for 42 years and a stockholder in Michigan Sugar. Spero helped start the Sugarbeet Advancement Committee and served as its chairman for two years. "But producers didn't have much faith in these small plots. We never saw the conditions under which the research was conducted. The Sugarbeet Advancement Program research was easy to understand — we could actually see it on our farms."

Another component of the project's success has been the immediate availability of the results.

"We publish a research book each year," Poindexter said. "And we also hold seminars and other educational sessions for growers. We did some follow-up surveys and discovered that farmers who attended our seminars saw about a $30 per acre enhancement of their revenue, which is a total increase of $1 million."

Some of the beneficial information discovered through the Project GREEEN research includes:

- A new schedule for spraying fungicide to control *Cercospora* leaf spot can save growers $20 to $136 per acre. One of the most serious diseases affecting sugar beets, leaf spot is a fungal disease that attacks the foliage. It causes small dead spots and can turn the whole leaf black, resulting in lower crop yields and sugar content.

  "Growers can check a tool we have online to see if weather conditions are favorable for

Steve Poindexter *(right)* discusses on-farm research with sugar beet grower John Spero *(left)* and his son. Spero has been growing sugar beets for 42 years and says GREEEN research has helped him improve productivity.

the development of leaf spot," Poindexter explained. "Based on the weather conditions for their area, the tool tells them when to spray. More than two-thirds of the growers have changed their leaf spot management practices because of this information."

- New management techniques to control *Rhizoctonia*, a fungus that causes crown rot in sugar beets. By studying the cumulative effects of variety selection, previous crop in the field, cultivation practices and timing of chemical controls for the fungus, researchers have been able to improve yield by as much as 5 tons per acre.

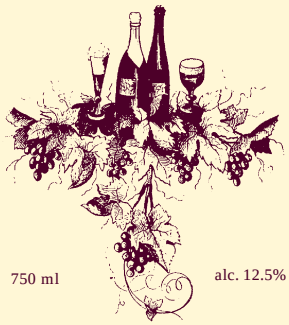
  "*Rhizoctonia* also affects dry beans and soybeans in rotation," Poindexter said. "Changing crops doesn't always break the disease cycle. Our research has developed a test that growers can use to determine if they need to spray."
- An earlier planting date can reduce seedling disease and improve stands and yields. Almost 27 percent of growers now plant during the last week of March, rather than the middle of April.
- Too much nitrogen can reduce beet emergence by 10 to 15 percent. Nineteen percent of producers have changed their nitrogen applications on the basis of these results.
- Counter™ and Temik™, two compounds used to control sugar beet cyst nematodes, were found to be associated with increased rates of *Rhizoctonia*. This helps explain why growers were experiencing variable results when using these compounds to control the pests.

"Personally, I'm using less nitrogen and planting my rows closer together," Spero said. "My sugar per acre has gone up. The direct contact I have with the researchers makes the work more real to me. This research is a major contributor to the industry's success in the last seven years. And it isn't just a few individuals that are benefiting — it's a lot of people. Production has gone up across the board."

"I'm absolutely in favor of this research continuing," Meylan added. "As the industry moves forward, the research has to move forward. I feel lucky that I was able to be involved in this. The more I know about the research, the more excited I am for our future."

::: Jamie DePolo

MERGING *Agriculture,* SCIENCE *and Art*



750 ml

alc. 12.5% by vol.

With some help from MAES researchers, the Michigan wine industry is becoming internationally respected for its vintages and cultivation techniques.

When Michigan denizens complement their meals with a bottle of wine produced by one of the state's 40 commercial wineries, they become part of a tradition that stretches back thousands of years and halfway around the world.

According to *The Origins and Ancient History of Wine* by Patrick McGovern, senior research scientist in archaeological chemistry and ceramics at the Penn State Museum's Applied Science Center for Archaeology, the first historical evidence of winemaking was in 8500 B.C. in the Near East. On today's map, the area would be in the northern mountains of Iran. Throughout the ages, people have preferred fermented beverages to water. Alcoholic drinks were safer, provided pleasing psychotropic effects and were viewed as more nutritious. As civilizations grew, wine and other alcoholic beverages continued to play an important role in trade, cultural interactions and religion.

"Making wine is an interesting mix of agriculture, science and art," said G. Stanley Howell, MAES horticultural scientist and an internationally renowned wine researcher. In 2003, Howell received the Lodi-Woodbridge Winegrape Commission's annual Wine Integrity Award for his more than three decades of dedication to the expansion and improvement of the Michigan wine industry. "It's art because of the subjective nature of taste," he continued. "And it's science because grapevine cultural techniques, variety evaluation and controlled cellar microbiology are critically important to quality wine production."

During his 35 years at MSU, Howell has seen and been a catalyst for a revolution in the Michigan wine industry. In 1969, 95 percent of Michigan wines came from three varieties: Concord, Niagara and Delaware, and most were grown in the southwest corner of the state. These varieties, from species native to Michigan, produced exceedingly average wine. The wine's quality was reflected in its price — most sold for less than $1 per bottle.

Today, only 3 percent of Michigan wine is made from these varieties. The industry is dominated by vinifera varieties, classic European grapes such as Chardonnay, Riesling, Gewurztraminer, Pinot Noir and Pinot Grigio. Almost 60 percent of Michigan wine grapes are vinifera. The other 40 percent of wines are made from hybrid varieties, crosses between vinifera and grapes native to North America, such as Vidal blanc, Traminette, Chardonel, Chambourcin, Marechal Foch, Seyval and Vignoles. In contrast to the initial clustering of the industry in southwestern Michigan in the early 1970s, commercial grape production now stretches from the Indiana state line to Northport, at the tip of the Leelanau Peninsula. Quality has improved dramatically — several wineries have had vintages recognized with international awards — as has the industry's economic contribution to the state. Wine production and winery tourism contribute $75 million to Michigan's economy each year, according to a recent study done by scientists in the MSU Department of Community, Agriculture, Recreation and Resource Studies.

MAES horticultural scientist Stan Howell is an internationally renowned wine researcher. He has dedicated his career of more than 30 years to expanding and improving the Michigan wine industry.

"The average price for a bottle of Michigan wine is $10," Howell said. "That's a major improvement, even when we account for inflation. We had 10 wineries in the state in 1969. Ten years ago we had 20, and today we have 40. There's been a huge increase in value and acreage. We're on the threshold of a big increase in acreage. I always said that before I retired there would be a commercial winery in every county on the Lake Michigan shoreline. Every county but one has a winery now."

As executive director of the Michigan Grape and Wine Industry Council (MGWIC), Linda Jones is excited about the future of wine in Michigan.

"We need more wine grape growers in

Linda Jones, executive director of the Michigan Grape and Wine Industry Council, says that MSU research has helped the Michigan wine industry grow and stay strong.

David Miller, vice president of wine making and viticulturist at St. Julian Wine Co. in Paw Paw, and an MSU alumnus who earned his doctorate with Howell, says the variety research done at MSU has been very important.

Michigan," she said. "Wineries help preserve farmland and offer business development opportunities for investors. The wineries are also popular tourist destinations. Part of our mission is encouraging growth of the industry, and we can steer people to good wine growing areas in the state. Michigan has 13,500 acres of vineyards, making us the fourth largest grape-growing state. But only 1,500 acres are devoted to wine grapes."

Because of the relatively inexpensive price of wine-producing land in Michigan, both Howell and Jones have seen an influx of investors and vineyard owners moving here from California and other wine-producing areas to start a business.

"In Napa, Calif., I saw undeveloped vineyard land selling for $100,000 per acre," Howell said. "Michigan land is cheap in comparison."

Bringing Europe to Michigan

The transformation of the state's wine industry is due in large part to the variety evaluation work that Howell began when he arrived at MSU from the University of Minnesota. A self-confessed novice ("I didn't have any grape and wine experience when I came here"), Howell, a Mississippi native, had studied freeze stress in apples in Minnesota.

"When I arrived here, Angelo Spinazzi, winemaker at Bronte Winery and Champagne Co., asked me if I could help the Michigan wine industry," Howell recalled. "I told him, yes, grape growing and wine production were agriculture. MSU was founded on the basis of dedication to that segment of the state's economy. I was told that European varieties wouldn't grow in Michigan. But I was young and stubborn, so I decided to plant these varieties on some plots at the former MAES field research station in Sodus. I planted a number of varieties and asked the growers and winemakers what they thought. We found that vinifera varieties would grow here — we just needed to use different cultural techniques."

Much of Howell's research since those early days has focused on selecting vinifera cultivars for cold tolerance and insect and disease resistance, continually improving and refining the varieties and cultural techniques that could produce economic success in Michigan's cool climate.

"Stan could have chosen to take his research to any number of institutions around the world," said David Miller, vice president of wine making and viticulturist for St. Julian Wine Co., Inc., of Paw Paw, Mich., the state's oldest winery. Miller worked for Howell while getting his master's and doctoral degrees at MSU. "Instead, he chose to stay in Michigan and tackle the more difficult challenge of helping to build an industry in a region that is 'climatically challenged' — Michigan. Stan's efforts are well appreciated by those who choose to stay abreast of the cutting edge in viticulture both at home and abroad. The variety research has been very helpful and very important."

"MSU has helped me with so many different things," said Joe Herman, who with his wife, Sue, operates Karma Vista Vineyards and Winery in Coloma. The land has been farmed by his family for 157 years, primarily in tree fruit, until he decided to convert some of it to wine grapes. "The variety trials have been the most valuable to me," he continued. "It's

Joe Herman, who operates Karma Vista Vineyards and Winery in Coloma, says MSU has helped him with many aspects of his operation.

great to see the actual vineyards at the Southwest Michigan Research and Extension Center (SWMREC) in Benton Harbor and see how the different cultural practices affect each one. I'm on the grower advisory board for SWMREC, and I'm very proud that the center brings researchers to the area. It's good to have the station here."

Other areas of Howell's research that have benefited the Michigan wine industry include rootstock evaluation, fruit quality and canopy management so that enough but not too much sun can get to the grapes.

"We definitely have challenges in Michigan," Howell said. "For example, Pinot Noir grapes grow in tiny, tightly packed clusters. In Michigan, we have rain during the harvest season, which means the grapes are more susceptible to rot. If one berry in the cluster rots, it ruins the whole cluster. We're doing research to reduce the compactness of the cluster, which we hope will reduce the incidence of rot."

Though Howell is the elder statesmen of MAES wine researchers, other scientists also are adding to the industry's body of knowledge. Work by Tom Zabadal, SWMREC station coordinator, on vineyard establishment, vine spacing and maintaining fruiting potential for tender varieties through the winter has produced a number of educational publications for Michigan growers. Rufus Isaacs, MAES entomologist, has done research on screening and registering pesticides for grapes, as well as integrated pest management (IPM) techniques for grape growers. Some of this research was done with Herman at Karma Vista Vineyards. Annemiek Schilder, MAES plant pathologist, is studying how to control phomopsis cane and leaf spot, caused by the fungus *Phomopsis viticola*. It is a disease of increasing concern in Michigan and affects both juice and wine grapes. Niagara, Concord, Vignoles, Chancellor, Chardonnay and Cabernet Sauvignon are all susceptible to it.

"We are constantly challenged by society to refine our methodology, to reduce inputs," Howell said. "Michigan's climate makes it tough on the grapes. We have to create a balance in the vines so that we have enough of the grape crop that can mature while still having enough leaves to support the fruit and help the plants tolerate insect, disease and environmental stresses. We're learning just how much leaf area we need. I believe the future will bring frequent assessment of the vineyard for vine crop status much as we are now doing for disease and insect management through IPM programs."

In a different discipline, a group of researchers affiliated with the MSU Travel, Tourism and Recreation Resources Center — including MAES tourism scientist Don Holecek and Ed Mahoney and Dan Stynes, researchers in the Department of Community, Agriculture, Recreation and Resource Studies — completed a marketing and economic analysis of Michigan's wine industry and wine tourism in 2002.

"Research done at MSU helps the Michigan wine industry stay strong," said Jones of the MGWIC. "We need the information from the economic analysis to do marketing. Besides telling us how much value the wine industry adds to the state, the study also found that more than 60 percent of people who visited a winery

Don Coe, managing partner at Black Star Farms in Suttons Bay, uses MSU research to market his winery. Besides the winery, Black Star Farms includes a bed and breakfast, stables and a creamery, which is home to the Leelanau Cheese Company.

used the Internet to get travel information. We've been encouraging wineries to put as much time as possible into creating and maintaining their Web sites. It's a very important marketing tool for us. Wine tastings and tasting rooms are also very important, and the Web can support them as well."

Jones said the MGWIC is planning to use the results from the marketing and economic analysis again to create an image for the Michigan wine experience.

"All the wineries are different," she said, "but they're all part of the Michigan winery network. We want to have one image that captures the experience of Michigan wine, whether it's visiting a winery or purchasing the wine. The Michigan wine industry is unique because we use fruit grown in the state. Many use imported grapes."

"We use Ed Mahoney's study extensively," said Don Coe, managing partner at Black Star Farms, in Suttons Bay. Besides the winery, Black Star Farms includes a bed and breakfast, stables and a creamery, which is home to the Leelanau Cheese Company. "I am a member of the Leelanau County Economic Development Commission, as well as serving on the advisory boards of the Great Lakes Culinary Institute and the Grand Rapids Community College Culinary Program, and I use this information extensively to demonstrate the importance of winery tourism to both the dining and lodging industries. In our own winery, we use this information as a training guide for our tasting room personnel, focusing on the drivers of winery tourism to ensure we deliver a great experience for our guests."

The Character of Michigan Wine

Research on varieties and how to grow the highest quality grape is only half the story in producing great wine. Other research on flavor chemistry, yeast strains, fermentation, and the use of oak barrels and their contribution to the flavor round out the body of knowledge on Michigan wines.

"Michigan wines are classic cool-climate wines," Howell explained. "Our wines have a fruit-forward flavor — you can taste the grape. Then we use barrel maturation, much as a cook would use spices, as a production technique to enhance the flavor, which is subtle. These wines are more food-friendly; they're balanced to be good matches with food. That's why there is so much interest in Pinot Gris.

"I believe we are producing world-class Riesling, Pinot Gris and sparkling wine," he continued. "Our Chardonnay is very close. I knew we had turned a corner 25 years ago when the food critics in Detroit started writing good things about Michigan wines. People don't realize how good Michigan Chardonnay is."

Howell said that he sees production of world-class Michigan red wines coming very soon.

"They're very good now, but the Pinot Noir, Merlot, Cabernet Franc and Cabernet Sauvignon will soon be world-class," he said. "It is a challenge to grow Cabernets in Michigan because they can produce an undesired herbaceous flavor in the resulting red wine. We're experimenting with additional vineyard production techniques and with several modified cellar methods to solve the problem. We will solve the problem, and when we do, our very good red wines will be world-class red wines."

Howell says Michigan is producing world-class Riesling, Pinot Gris and sparkling wines. The state's Chardonnay is very close, and production of world-class reds should start very soon.

Howell sees a role for both world-class wines, what he calls "reputation-building wines" that are more expensive, and good, solid, reasonably priced wines that he refers to as "bill-paying wines."

"As we expand into world-class production, I think there will be a continued place for bill-paying wines," he said. "Not everyone can afford or wants to pay a lot for a bottle of wine, but they still want to enjoy a good, quality Michigan wine. There is a market for both types."

Creating Leaders

Educating the industry's current and future leaders is the third component cementing the strong partnership between MSU and the Michigan wine industry. Researchers hold regular educational programs during the year for growers, both on-campus and at MAES field research stations around the state, such as SWMREC and the Northwest Michigan Horticultural Research Station in Traverse City.

"The viticulture and enology program at MSU is important because it is a source of well-educated employees who will keep the industry going," Jones said. "And the field days and grower education programs are well attended; they're a good way to transfer the information from the lab to the producer.

"Much of Stan Howell's research has been conducted here in Michigan, where our industry has been fortunate to benefit from the close proximity to leading research on vine physiology," she continued. "While his research contributes to the body of knowledge globally, he and his staff take time to offer educational programs and consultation with the local industry. Two of his doctoral students are now prominent winemakers in Michigan's industry."

"I think our programs are the land-grant tradition personified," Howell said. "We find solutions to practical problems and we educate people on the principles associated with those problems. This field attracts a lot of starry-eyed people — part of my job is to break them of that. Wine making is cash-intensive and requires a lot of hard work. As long as a wine grower understands the principles of viticulture and enology, he or she can modify them to accommodate local conditions and apply them anywhere.

"We want to have home-grown people at the front edge of the Michigan wine industry," he added.

"One of the best things Stan has done is produce people like Dave Miller and Charlie Edson [who owns and operates Bel Lago Vineyard and Winery with his wife, MAES horticultural scientist Amy Iezzoni]," said Karma Vista's Herman. "These are the new leaders who are taking our industry into the future."

"MSU taught me how to be a critical thinker," Miller said. "We weren't just learning recipes. I value the MSU program a lot. When I came to St. Julian, I saw that people weren't using the latest information. I tried to improve that, based on what I had learned at MSU from Stan, and use the latest information to improve our product. As the industry grows, we need new information and we look to MSU for that."

::: Jamie DePolo

International Ties Boost Animal Production Research

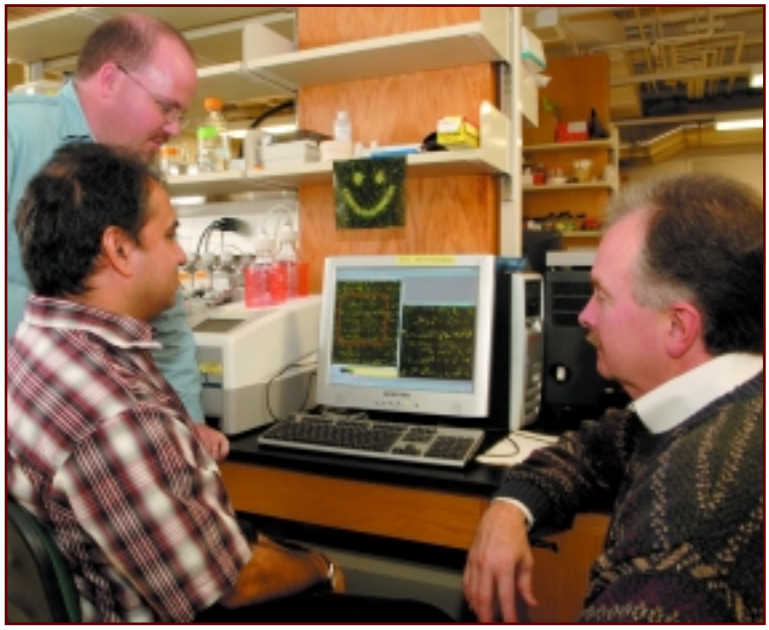
MAES scientists are collaborating with researchers in Ireland to enhance animal agriculture profitability in Michigan

ANIMAL AGRICULTURE AND ITS ASSOCIATED PRODUCTS — milk, meat, wool, eggs, cheese and butter — make up a significant portion of Michigan's economy. According to numbers from the Michigan Agricultural Statistics Service, the state is eighth in the country in milk production, 14th in hog production and 31st in cattle production. Michigan cattle and calves were valued at $871 million in 2003, and poultry production, including eggs, turkeys and chickens, was worth $122 million in 2002, up 4 percent from the previous year. Excluding poultry, Michigan exported $53 million worth of live animals and meat to other countries in 2002, placing it in the top 20 of U.S. exporters for these commodities.

Thanks to the popularity of the Atkins and South Beach diets, protein is the food of choice for those trying to lose weight, which is good news for Michigan livestock producers. Estimates are that 40

percent of Americans are increasing their consumption of protein while reducing their carbohydrate intake. Eggs, bacon, cheese and beef are back in style, and Michigan farmers are looking for new ways to meet this increased consumer demand with high-quality products.

Enhancing profitability in animal agriculture means research on new methods to combat diseases, as well as work on selecting cows with desirable traits, such as high milk production, high fertility and longevity in the herd, and research into new ways to add value to the raw products, such as new types of dairy or meat products.



Left to right: MAES animal scientist George W. Smith, visiting scholar Osman Patel and MAES animal scientist Jim Ireland are studying ways to select cows with desirable traits such as high milk production, high fertility and longevity in the herd.

MAES ANIMAL SCIENTIST JIM Ireland studies bovine reproduction, searching for new techniques to improve the reproduction efficiency of cattle. Dairy and beef cattle farming requires large up-front investments — the animals must be purchased, fed, housed and seen regularly by a veterinarian. Any cows that do not reliably produce calves to replenish the herd become even more expensive. Ireland, who is also director of the MSU Molecular Reproductive Endocrinology Laboratory, is just one of several MAES animal scientists working in this area, and helping MSU build an international reputation in the animal reproduction genomics discipline. Others include George W. Smith and Richard Pursley. MAES animal scientists Jeanne Burton, Jose Cibelli, Paul Coussens, Matt Doumit and Cathy Ernst also study different aspects of animal genomics.

Ireland also has the distinction of starting a collaboration with animal science researchers in the Republic of Ireland — a relationship that began more than 25 years ago when he arrived at MSU.

"I came to MSU in 1977, and Jim Roche, from University College Dublin, was here on sabbatical," Ireland explained. "The scientist that Jim Roche was supposed to work with left MSU, so he and I were kind of thrown together. It worked out very well. We were fortunate because the MAES supports and fosters international collaboration, so our program grew from there.

"Animal reproduction is an extremely competitive field," he continued, "so this international partnership has helped us build a stronger research group and better projects. It definitely gives us an advantage."

Initially the researchers focused on bovine reproduction, but the program grew into a much larger collaboration over the past 25 years.

"Each group sponsors research fellows that go back and forth," Ireland said. "Visiting scientists and students come to MSU and do research with our scientists in the Center for Animal Functional Genomics. The exchange program allows us to develop synergies and draw on the strengths of each institution to make both of us and the research stronger. We can both benefit from grants that the other receives because we're not competing with each other. There is a real sharing of knowledge."

Current joint MSU-Ireland research projects include identifying new genes that are markers for higher fertility, growth and other important traits in cattle and other animals important to agriculture, such as pigs.

"Most of the work is basic research," Ireland explained, "identifying the genes and learning what they control. We're laying the foundation for the development of methods to improve reproduction, growth efficiency, and the health and well-being of the animals."

Some of the research is more applied, however, including developing and evaluating new and improved artificial insemination (AI) techniques for cattle, the effort that Pursley leads.

FEWER THAN 10 PERCENT OF BEEF CATTLE PRODUCERS IN THE UNITED States use AI per year, while dairy producers use AI on 70 percent of their lactating cows and 50 percent of their heifers. AI can be expensive, costing approximately $50 per cow per insemination from a champion bull. And if the cow doesn't get pregnant from the AI, then the producer has to try again, which raises the cost.

"One of the biggest costs for producers is replacing animals that do not reproduce," Ireland said. "So while we are investigating improved AI techniques for cattle, we're also studying potential new ways to identify high-fertility cows — cows that get pregnant easily."

Each bovine ovary has hundreds of thousands of eggs. Each egg is surrounded by a group of support cells called the granulosa cells. Together, the egg and these cells are housed in a follicle. The granulosa cells maintain the egg in a state of suspended animation until the follicle receives a signal to resume growth,

ultimately leading to ovulation. By using ultrasound imaging of the follicles, Ireland hopes to be able to distinguish high fertility cows from those with average or low fertility.

"We're developing and testing the techniques," he explained. "We're anticipating having results in about a year. So while much of our research is basic research, we are doing some applied work as well."

MSU's collaboration with animal science researchers in the Republic of Ireland began more than 25 years ago. The international partnership has helped MSU build a stronger research group.

MAES animal scientist George W. Smith is approaching fertility research from a different angle. He is using genomic technology to understand what makes a good egg — one that is likely to develop into healthy calf.

"We're looking at the catalogue of genetic information in the eggs to see what needs to be there for the egg to be high quality, with a greater chance for pregnancy success after it is fertilized," Smith explained. "If we can identify these characteristics, then we may be able to help producers select cattle with a greater chance of becoming pregnant. Our goal is to increase the likelihood that a cow will get pregnant after the first time she is serviced or undergoes AI."

According to Smith, approximately 65 to 75 percent of dairy cows don't get pregnant on the first try, which means added costs for producers.

The work may also have implications for people.

"There are certainly applications for human beings," Smith said. "Today, we have more older women trying to get pregnant but with less success, and egg quality may play a role in this. As women age, the quality of their eggs decreases; that happens with all mammals. Many people who have difficulty becoming pregnant try *in vitro* fertilization techniques, and our work may be able to improve that process."

When a woman undergoes *in vitro* fertilization, the doctor harvests eggs from her ovaries and fertilizes them all, creating embryos. The most promising-looking embryos are implanted in the uterus.

"There are a lot of ethical issues surrounding what to do with the extra embryos," Smith said. "Some people don't want them to be destroyed. What happens if the couple divorces? Who gets custody of the embryos?

"If our work is successful, the eggs could be evaluated for quality before fertilization," he continued. "Only the one or two highest quality eggs would be fertilized, so there wouldn't be any extra embryos."

Smith, who has been part of the MSU-Ireland program for a few years, agrees with scientist Ireland that the collaboration has been extremely beneficial to his research.

"It's allowed me to work with the top researchers in the area who work in Ireland — the MAES has made a tremendous investment in this program," he said.

Besides the exchange of scientists and students, the collaborative program has allowed Smith and Ireland, with the support of the MAES, to hire a top visiting scholar. Osman Patel, who is from Zambia and earned his master's degree in veterinary medicine from the University of Glasgow, in Scotland, and his doctorate in veterinary medical sciences from the University of Tokyo, though not from Ireland, is part of the MSU-Irish collaboration. The MAES research agreement with the Irish version of the experiment station, Teagasc, called for each group to hire a research fellow to work on the egg quality project, one at MSU and one in Ireland. Patel began work in Smith's lab nearly a year ago.

"Osman has done a tremendous amount of work and made a very important contribution," Smith said. "He's refined the technology we use to study the eggs. Before, we had to use thousands of eggs to do the research. Now we can use only a handful of eggs. It's been extremely beneficial."

"My time here has been challenging and definitely worthwhile," Patel said. "It's a very good program."

According to Jim Ireland, another benefit of the collaborative program is its ability to lay the groundwork for new, as-yet-to-be-imagined research programs.

"There are many ways to approach enhancing animal production," Ireland continued. "The molecular level is just one approach. But if we can demonstrate that genes can be used to identify animals with desirable traits, and if we can identify the animals earlier so producers aren't wasting money raising animals that are undesirable, then we are benefiting the animals and the producers. This research collaboration with Ireland has given MSU a strong foundation in cutting-edge basic research. It's helping us now, but it's also allowing us to prepare for the future and create a new way to do research."

::: Jamie DePolo

Research *in the news*

Acting Director Enjoys Debunking Experiment Station Stereotypes

John C. Baker, the associate dean for research and graduate studies for the MSU College of Veterinary Medicine (CVM), was named acting director of the Michigan Agricultural Experiment Station on Nov. 1. Ever since, he's had some explaining to do.

A current CVM student e-mailed Baker to wish him well in his new assignment, writing: "I hope you are enjoying your time away from the university!" Then a colleague from the University of Michigan wrote to ask where exactly "the station" was located. When Baker explained that he was right on the MSU campus in Agriculture Hall, his Go Blue colleague replied: "The way I envisioned it, your new position was in some remote igloo... Glad to hear you are still in civilization!!"

"Of course, the MAES is much more than a single farm," said Baker, who seems to enjoy correcting misconceptions about agricultural experiment stations and reminding people about the history of land-grant universities. He's begun carrying the MAES annual report in his briefcase, complete with the map showing MAES facilities around the state, to give impromptu lessons. "For starters, people should know that we manage 15 research stations around Michigan and support much of the research conducted by MSU academic departments at MSU's south campus experimental plots in East Lansing," he said, pointing to the annual report's map and explaining how one of these lessons might begin.

However, Baker acknowledges that the e-mails reflect one of the challenges facing the MAES and other agricultural experiment stations around the country. Even though "the station" does much more than serve growers and producers, people still think of the MAES in this rather narrow historical role.

The scope of the MAES is anything but narrow. MAES dollars support research on economic development, food safety, land use planning, watershed management, family and community development and dozens of other areas relevant to citizens across Michigan. Baker says he's looking forward to speaking up about this relevancy over the next year and beyond.

John C. Baker

Baker's other goals for the year — he's adamant that he'll return to his fulltime CVM duties next fall — include:

• Participating in efforts to complete AAALAC accreditation across campus, including in the CVM and the College of Agriculture and Natural Resources (CANR). AAALAC — the Association for Assessment and Accreditation of Laboratory Animal Care — is a private, nonprofit organization that promotes the humane treatment of animals in science through voluntary accreditation. Accreditation will allow MSU to be more competitive in animal-related research and to maintain compliance with regulatory agencies. Animals are an important part of MSU's mission in teaching, extension education and research. AAALAC accreditation will demonstrate MSU's commitment to the highest standards of animal care, Baker says.

• Lending MAES leadership to discussions about high level containment facilities for both plant and animals at MSU. In the post-Sept. 11 world, these types of facilities are needed for MSU to be fully engaged in research related to bioterrorism and agroterrorism. The MAES funds research that affects the health of human, animal and plant populations, so is in a natural position to lead this issue.

• Being prepared to clearly communicate the capabilities and potential of the MAES, and otherwise laying the groundwork for the incoming director to be successful.

• Most importantly, preserving and strengthening support for existing MAES activities, and remaining fiscally sound in an environment of flat or declining budgets.

Baker credits outgoing director Ian Gray with doing an excellent job steering the MAES through several funding challenges over the last few years, though he adds: "I don't think that funding challenges are permanently behind us. But I also don't think that tight budgets or other hardships should squelch innovation."

In fact, when it comes to remaining energized about innovation, Baker looks back to the history of the land-grant universities for inspiration. President Abraham Lincoln signed the Morrill Act in 1862, establishing land-grant colleges in every state and placing instruction in agriculture and home economics in higher education. This was quite an accomplishment in the midst of the Civil War, arguably the most divisive and uncertain time in our country's history.

"You've been at U of M too long and are losing your land-grant roots," Baker chided his Ann Arbor colleague, who also happens to be a graduate of Indiana's land-grant university, Purdue. "Every state has an agricultural experiment station at the land-grant university."

Baker has spent his entire career at land-grant universities. He received his bachelor's, master's and doctor of veterinary medicine degrees from Ohio State University. He then moved to the University of Minnesota where he completed a clinical internship and clinical residency and also received a doctorate in large animal clinical sciences.

Baker began his MSU career in 1984 in the CVM's Department of Large Animal Clinical Sciences. Ever since, he's served in various academic and administrative leadership roles. Most of Baker's time in the coming months will be spent at the MAES, though he has retained his ties to the CVM where he currently serves as associate dean and professor of large animal sciences. MSU is conducting a

national search, with the goal of having a permanent director of the MAES in place by fall 2005.

MSU, the nation's pioneer land-grant university, has been a permanent fixture in Michigan for 150 years. Baker seems pleased that his stint at the MAES coincides with the university's sesquicentennial anniversary. "I think it's important for faculty, administrators, staff and students to help the university formulate its future vision and to step up and take on new responsibilities when asked," he said.

When asked about the type of the activities supported by the MAES, Baker flips past the maps in the annual report. He notes that the MAES partially funds the work of more than 350 researchers in more than 20 academic departments, research centers and campus laboratories.

"The span of influence at the MAES is greater than that of any single MSU college," he said. "I'll know a lot more about MSU by the time he heads back to the CVM next fall."

If his well-thumbed annual report is any indication, Baker's colleagues, friends and neighbors will know a lot more about the university, as well — especially about the MAES.

::: Geoff Koch

Chicken Genome Analysis Will Benefit Human Health and Agriculture

We may soon be thanking Michigan State University chicken No. 256 for better treatments or even new vaccines for the flu and other human ailments.

As the first bird and the first agricultural animal to have its genome sequenced, the chicken is paving the way for research on human diseases, as well as studies on chicken breeding to benefit agriculture. An international consortium of scientists that includes an MAES researcher analyzed the chicken genome and published a paper in the Dec. 9 issue of the British science journal *Nature*.

The first draft of the chicken genome was placed into free public databases for use by researchers around the world in March 2004.

The bird whose genome was sequenced, a red jungle fowl (*Gallus gallus*) known by her wing band number, 256, still lives on the MSU campus in a facility that serves the lab of Jerry Dodgson, MAES microbiology and molecular genetics researcher, who has worked on mapping the chicken genome for the past 17 years. At 7, she's quite old for a chicken and is oblivious to the importance of her contributions to science.

No. 256 was chosen as the genome model because she's from an inbred line; this makes her genome more uniform than non-inbred chickens. Also, red jungle fowl represents the wild type species from which all domestic chickens came. A female was chosen because female birds contain a sex chromosome (called W) that male birds lack. She also provided DNA used to create recombinant DNA clone maps of the chicken genome. Those maps provided the framework for the much more detailed genome sequence assembly.

"Chickens and humans are, in some cases, infected by the same viruses, bacteria and parasites," said Dodgson, one of the coordinators of the International Chicken Genome Sequencing Consortium, which sequenced and analyzed the red jungle fowl genome. "The research shows that chickens and humans share more than half of their genes. The chicken genome sequence is expected to help us uncover genes that enhance natural disease resistance in birds. Then we can see if those same genes are in humans."

Widely used in biomedical research, the chicken is an important model for vaccine production and the study of embryology and development, as well as for research into the connection between viruses and some types of cancer.

Dodgson said the sequenced genome may someday allow poultry producers to know why certain chickens lay more eggs than others or why certain broiler chickens may have less fat. They then can identify commercial chickens with the same genetic predisposition to these desirable traits.

"If we know the genes that influence these traits, we can select for chickens that better meet consumer demand and, at the same time, are healthier, themselves," he said.

"The chicken genome fills a crucial gap in our scientific knowledge," said Francis S. Collins, director of the National Human Genome Research Institute, which is part of the National Institutes of Health, which

Jerry Dodgson and chicken No. 256

funded the chicken genome sequencing project. "Located between mammals and fish on the tree of life, the chicken is well positioned to provide us with new insights into genome evolution and human biology. By comparing the genomes of a wide range of animals, we can better understand the structure and function of human genes and, ultimately, develop new strategies to improve human health."

"Having the chicken genome sequenced is a fundamental tool for doing research in chicken genetics," Dodgson explained. "Now, whatever trait we want to look at — whether it's resistance to a virus or how the bird responds to a new type of feed — we can home in on the genetic component."

He compared biologists' knowing the genome sequence to a sociologist's wanting to study the population of New York City and using a telephone directory.

"How useful is the phone book for

that?" he asked. "It doesn't provide answers on its own, but it does give you a summary of who's there and how to reach them. It's a starting point for asking and answering all the more complex questions. That's what sequencing the genome does for us — now we know where all the genes are, and we can analyze them and find out what they do."

Researchers estimate that the chicken has between 20,000 and 23,000 genes in its 1 billion DNA base pairs. The human count is 20,000 to 25,000 genes in 2.8 billion DNA base pairs.

Like all birds, chickens are thought to have descended from dinosaurs in the middle of the Mesozoic period and have evolved separately from mammals for at least 310 million years. Chickens were first domesticated in Asia, perhaps as early as 8000 B.C.

The consortium was made up of more than 175 scientists from China, Denmark, France, Germany, Japan, Poland, Singapore, Spain, Sweden, Switzerland, the United Kingdom and the United States.

Canola Study Solves Seed Oil Mystery

An MAES scientist is part of an MSU team that uncovered a previously unknown metabolic mechanism used by plants to create seed oil.

The results, described in the Dec. 9 issue of *Nature*, the British science journal, address a longstanding question in plant biology — why do oilseed plants rely on a seemingly inefficient metabolic process to produce such prodigious amount of energy-rich oil? The answer, according to the MSU team, is that plant seeds are more efficient than anyone thought.

"Seeds achieve this high efficiency by using long-known biochemical reactions that are combined in an unconventional way, which had not been expected by biochemists," said Jörg Schwender, MSU plant biology professor and lead author of the study. MAES plant biologist and university distinguished professor John Ohlrogge was one of the paper's co-authors.

The researchers studied canola, an annual crop in the mustard family that is widely cultivated throughout the Upper Midwest, Canada, Europe and Asia. The oil extracted from the seeds of this plant is used to make everything from margarine to industrial lubricants.

Seeds store large oil reserves to use as energy when the time comes to germinate and grow. In canola, for example, oil can comprise half of the seed's weight.

People have long exploited these oil-rich plants. People in India and China have processed canola seeds into oil for cooking and lamps for 4,000 years.

In more recent history, the rise of modern biochemistry over the last few decades has increased interest in making quantitative descriptions of plants and animals' biochemical reactions.

When it came to canola, the biochemical balance sheet just didn't add up. As far as researchers could tell, the seeds were relying on an inefficient pathway to produce their sought-after oil.

All plants use carbon from carbon dioxide, a basic part of the Earth's atmosphere, to make compounds such as sugars, oils and proteins in stems, leaves and flowers.

To harvest carbon from the air, plants go to a lot of trouble to convert carbon dioxide into simple sugars. When canola then transformed these sugars into oils, the plants appeared to give off large amounts of carbon dioxide.

In its research, the MSU team tagged carbon atoms and tracked how they were processed by developing canola seeds.

During the conversion of sugars to oils, researchers expected to see the tagged carbon go through a step-by-step series of chemical reactions known as glycolysis, used by all plants and animals to turn sugar into energy and cellular building blocks. This energy, in turn, is used to link the carbon building blocks into molecules of oil.

Instead, the scientists observed an enzyme called Rubisco providing a more efficient pathway to convert sugar to carbon chains for oil. And the pathway involved much less carbon dioxide emission.

Scientists have long known that in the process of photosynthesis, Rubisco is the key enzyme that captures atmospheric carbon dioxide for conversion into sugars.

However, the MSU team was surprised to see Rubisco — the enzyme's shorthand stands for ribulose bisphosphate carboxylase/oxygenase — also acting as a key agent producing oil in the seed.

In fact, in terms of metabolic heavy-lifting, Rubisco appeared to be much more efficient than glycolysis. The newly uncovered Rubisco bypass pathway produced 20 percent more of the carbon chain building blocks to make oil while losing 40 percent less carbon dioxide than is lost during glycolysis.

The results cast new light on the seemingly well-understood protein Rubisco, which accounts for 50 percent of a plant's total protein content and is likely the mostly abundant protein on Earth.

Through its role in grabbing carbon atoms from atmospheric carbon dioxide, Rubisco has been recognized as the main chemical gateway for carbon to enter the biosphere. The new findings suggest that Rubisco also gives plants a way to greatly reduce losses back to the atmosphere while they're synthesizing oil.

In addition to enzymes, plants need energy for all this carbon-culling. They capture it using chlorophyll, a molecule responsible for plants' green coloring. Chlorophyll uses energy from sunlight to make sugars and other compounds in plants.

It takes lots of light energy to capture carbon dioxide, which is why plants have broad canopies of light-catching leaves. The Rubisco pathway that operates in seeds also requires light energy, but only a fraction of the energy needed by leaves.

In fact, the small amounts of chlorophyll in a canola seed, which has a diameter of about one-eighth of an inch, may grab enough sun energy to switch on the Rubisco-only reaction.

"Understanding the pathways plants use to make oil will help us to develop new crop varieties with greater oil content," said Ohlrogge. "And this becomes especially important as the world depletes its supplies of petroleum."

New Pheromone Creates Buzz about the Clout of Older Bees

A recent discovery by an MAES scientist has unveiled the chemical secret that gives old bees the authority to keep young

Research *in the news*

Zachary Huang

bees home babysitting instead of going out on the town.

A hard-to-detect pheromone explains a phenomenon that MAES entomologist Zachary Huang described in a paper 12 years ago — that somehow older forager bees exert influence over the younger nurse bees in a hive, keeping them grounded until they are more mature and thus more ready to handle the demands of buzzing about.

The work that identifies the chemical, "Regulation of Behavioral Maturation in Honey Bees by a New Primer Pheromone," was published in *Proceedings of the National Academy of Science Biological Sciences, Population Biology, Early Edition*, in November.

"If the older ones don't keep them in check, the young ones can mature too quickly," Huang said. "It's kind of the same thing as with people — you need the elders to check on the young. Even if the young are physically able to go out on their own, it's not the best situation for the bees, and now we know how it works."

Huang worked with a team from the United States, France and Canada to explain how the bees keep an exquisitely consistent balance between the ones that go out to collect nectar and pollen and defend the hive, and those that stay home and nurture the larvae. Huang had documented that this balance is controlled by the elder bees, those that typically spend the final one to three weeks of their five-week lifespan out in the field.

Experiments showed that if a significant number of forager bees didn't come home, the young nurse bees would mature ahead of schedule and head out to become foragers themselves. If the older bees were kept inside more than usual — as in an extended rain shower — fewer young bees would mature but instead stick to brood care.

But the question was always why? Huang and his colleagues suspected a pheromone might be responsible. Pheromones are chemical signals emitted by animals, insects and humans. Some, called releaser pheromones, are like a quick conversation that changes behavior, such as those that inspire sexual attraction. Others, called primer pheromones, cause behavioral changes over a much longer time period, taking days or weeks to have an effect.

Because releasers change behavior immediately, they historically have been easier to identify. Hundreds of releaser pheromones have been chemically identified, whereas only four (including this new one) primer pheromones have been identified.

Huang and his associates spent years futilely searching for a primer pheromone. After many dead ends, the group came upon a crucial difference between forager bees and nurse bees: forager bees carry a large amount of the chemical ethyl oleate in the abdominal reservoir in which they store nectar.

That, Huang said, led them to identify ethyl oleate as a primer pheromone.

Forager bees load up on ethyl oleate when they're buzzing about gathering food, but they don't digest it. The forager bees then feed the chemical to the nurse bees, and it keeps the nurses in something similar to a teen-age state.

As the old bees die off, the chemical no longer is fed to the nurse bees. Eliminate ethyl oleate and the bees mature into foragers.

Huang said the system makes sense for the health of the hive. Young bees — those in the first two to three weeks of life — are biologically better suited for brood care, thanks to some boosted blood protein. Bees forced out too early aren't great navigators, and because foraging is dangerous, they risk dying before their time.

"Our idea has never been disproved, but the lack of mechanism drove me crazy," Huang said. "Now we know the specific chemical that controls the behavior of honey bees for the good of the whole population."

MAES Research Shows How Common Soil Minerals Might Mop Up Pesticides

New research by an MAES scientist suggests that dousing soils with solutions rich in everyday minerals and salts might help soils more effectively soak up pesticides and other organic contaminants.

The work, detailed in a recent issue of the journal *Environmental Science & Technology*, shows that the sponge-like properties of soil clays can be changed, especially by tweaking concentrations of naturally occurring potassium.

The new findings by Stephen A. Boyd, MAES crop and soil sciences researcher, and colleagues at MSU and Purdue University, may help build models that better explain the role of basic minerals in the spread of pollutants in soils. These, in turn, may lead to more effective phytoremediation — the use of plants to remove contaminants from the soil.

"This chemistry provides the basis to reliably and inexpensively control the leaching of important classes of contaminants and to improve the effectiveness of bioremediation technologies such as phytoremediation," Boyd said.

This is how it works: The minerals in the soil initially soak up the pollutants. Over time, however, the minerals slowly release their grip on the pollutants. This slow release makes it easier for the plants used in phytoremediation to remove the contaminants from the soil.

In their research, Boyd and colleagues mixed common clay with varying potassium and calcium concentrations and then tested how the various recipes responded to three pesticides. Soil minerals interact with and bind to all sorts of chemicals, so it was no surprise that the soils with more ions did a better job of soaking up the contaminants.

What was surprising, Boyd said, were the differences between potassium and calcium in holding contaminants. Depending on the pesticide, potassium-soaked soil proved to have between four

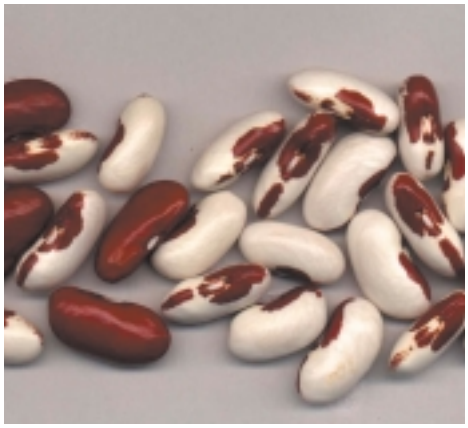
and 75 times the sponge-like ability of soil soaked with calcium.

"A little potassium goes a long way," Boyd said. "Small increases in potassium concentration made the soil sample significantly more absorptive."

X-ray diffraction helped explain why, he said. X-ray images show that, at low concentrations, potassium ions aren't distributed evenly through the soil. When the concentration gets high enough, the miniscule spaces between soils' basic building blocks become potassium-saturated, and soon the entire soil cross-section starts soaking up pesticide.

In their paper, the authors also describe several potential applications of their findings, including more environmentally friendly techniques to apply pesticides and more effective ways to clean up contaminated soil.

Genetic Quirk, Detective Work Yield New Bean



Don't let the name fool you — the new Redcoat bean is mostly white. More interesting than Redcoat's moniker, however, is how researchers from the MAES sleuthed to Texas and back and delved into DNA to discover it. Because of their work, dishes from vegetarian chili to bean burgers might have a new, lighter look in the future.

"The opportunity to commercialize a mutant bean which we would never have worked on directly is a nice surprise, given that bean variety development is usually a 10-year program," said Jim Kelly, MAES crop and soil scientist. Kelly is co-author of two papers describing Redcoat development that will appear in the journal *HortScience* in 2005.

The Redcoat bean is part of the family of Soldier beans, so named because their red markings look like the uniforms worn by 18th century European soldiers. Redcoat is an addition to the Michigan dry bean market, which also includes navy, small white, black turtle, pinto, cranberry and yellow eye beans.

Collectively, these beans are big business in Michigan. The Great Lakes State grows more dry beans by weight — nearly 400 million pounds per year — than any other state except North Dakota. Over the years, work done by the MAES has led to new disease-resistant bean varieties that thrive in Michigan's sometimes harsh climate.

In 1999, MAES scientists obtained seeds for basic red kidney beans from a Texas supplier. Researchers planted the seeds in northern Michigan, and most of the plants did, in fact, produce the promised red beans. However, a small fraction produced beans with striking white splotches.

The researchers first suspected that the coloring had a prosaic explanation — perhaps stray seeds from white bean plants had gotten mixed in with the seeds in Texas, or cross-pollination had occurred with fields of white bean plants in the nearby area.

However, when the MAES team searched the area in northern Michigan where the new red and white bean turned up, they found no cross-pollination suspects, such as other Soldier bean varieties. And when they infected the plants with two common bean diseases, the Redcoat beans behaved more like other red kidney beans than white beans.

Over the years, red kidney beans have been bred to resist the diseases picked by the scientists — common mosaic virus and anthracnose. Redcoat proved immune to infection as well, even though these diseases are often lethal to plants producing other Soldier bean varieties.

"Redcoat has the best yield potential of any Soldier bean," said Greg Varner, research director of the Michigan Dry Bean Research Board and co-author of one of the *HortScience* papers.

What about the possibility of a mix-up in Texas? The MAES team inquired and learned that the Texas supplier had hand picked the beans sent to Michigan. The entire batch contained nothing but beans with the familiar, uniform red coloring.

It's uniformly true that most living organisms carry two copies of each gene. With other explanations ruled out, MAES scientists began suspecting that one copy of the bean color gene had mutated. They thought that the other gene had remained normal and still contained instructions for making red beans. Often, one normal gene is enough to mask the effects of a mutation. This would explain why all the Texas seeds were red.

Random mutations, changes in DNA structure in the cells of a living organism, happen all the time. Most mutations have no effect on the organism or its offspring, and some prove harmful to the organism. Only a small fraction of mutations turn out to be advantageous. In this case, the big advantage is for bean lovers who might see a kidney-bean-flavored red and white bean in their local markets within the next few years.

It took several years' work in campus greenhouses, but the MAES scientists finally confirmed their suspicions. The new coloring was indeed the result of a rare beneficial mutation of a single gene in the bean's DNA.

"The single gene mutation of seed coat color pattern means that an entirely new class has the same valuable attributes present in the commercial red kidney class that breeders have worked on for more than a hundred years at MSU," Kelly said. The mystery is solved and the new bean is now available under license from MSU.

New MAES Faculty Members

The MAES is pleased to announce the appointment of the following new faculty members.

Katherine Alaimo was appointed assistant professor of food science and human nutrition in July. Her research focuses on hunger in the United States and its consequences for children; community food security; the benefits of urban agriculture/community gardening for public health, neighborhood social capital and urban redevelopment; promoting healthy eating and physical activity through policies and environments;

and community-based participatory research.

She received her doctoral and master's degrees in community nutrition from Cornell University in 2002 and 1997, respectively, and her bachelor's degree in nutritional science from Cornell in 1991.

Jose Cibelli, who has been at MSU as professor of animal science physiology and endowed chair for large animal biotechnology since January 2003, received an MAES appointment in July 2004. An internationally recognized expert on stem cell research, Cibelli focuses on embryonic stem cell cloning from animals, but he has expertise in all areas of cloning. In February, he helped validate groundbreaking research of scientists in Korea who created human embryos through cloning without fertilization. The results were published in the journal *Science*. In April, he was part of a briefing in Geneva organized by Italian members of the European Parliament and the Luca Coscioni Association for Freedom of Scientific Research and Treatment, a group of scientists and activists concerned that the United Nations would vote to ban human stem cell research for therapeutic purposes.

Cibelli was part of the team responsible for the generation of the world's first transgenic cloned calves, the first embryonic stem cells by nuclear transfer and the first embryonic stem cells by parthenogenesis in primates. He has published in *Science, Nature Biotechnology, Nature Medicine* and *PNAS*. He has testified about nuclear transfer and stem cells in public forums sponsored by the U.S. Food and Drug Administration, the National Academy of Sciences, the Canadian House of Commons and the U.S. Department of Agriculture. Cibelli is also the editor of the book *Principles of Cloning* published by Academic Press in 2002.

From October 1999 until December 2002, Cibelli was the vice president for research at Advanced Cell Technology in Worcester, Mass. He did his undergraduate work in his native Argentina and received a doctorate in veterinary medicine from the University of La Plata in 1989 and a doctorate in reproductive physiology from the University of Massachusetts in 1998.

Ning Jiang was named assistant professor of horticulture and affiliated MAES scientist in August. Her research explores the function of transposable elements — the "jumping genes" of plants — to understand the forces underlying genome diversification. She co-authored a paper in the Sept. 30 edition of the British science journal *Nature* on mutator-like transposable elements (MULEs). Of those, she has found that some carry fragments of cellular genes with them — dubbed pack-MULEs. The first pack-MULE she found in a piece of rice sequence was carrying the gene that triggers cold responses in a plant. Jiang is continuing to look at pack-MULEs to try to better understand their role in evolution. She also will explore other questions, such as the common use of MULEs in gene tagging, the process of interrupting a gene to understand its function.

Jiang received her doctorate in plant biology from the University of Georgia in 2002, her master's degree in plant physiology from Yangzhou University, China, in 1986 and her bachelor's degree in plant physiology and biochemistry from Nanjing University, China, in 1983.

Merritt Turetsky was named assistant professor of fisheries and wildlife and plant biology in August.

Turetsky is a wetland ecologist and biogeochemist. Her research focuses on monitoring ecosystem function in wetlands and boreal landscapes. She is interested in climatic and management impacts on wetland structure and function, quantifying carbon pools in ecosystems vulnerable to global change, and the connections of plant physiology and evolution to biogeochemical cycling.

Turetsky received her doctoral degree in ecology and environmental biology in 2002 from the University of Alberta, where she focused on carbon storage and fluxes in peatlands. She came to MSU from the U.S. Geological Survey, where she was a Mendenhall postdoctoral fellow from 2002 to 2004.

Ryan Warner was named assistant professor of horticulture in September. His research focuses on understanding the mechanisms plants use to tolerate stress — specifically, how flowers tolerate high temperatures. This area is part of his broader research goal, which is to improve production efficiency in greenhouse crops.

Warner received his doctorate in applied plant sciences and his master's degree in horticultural science, from the University of Minnesota in 2004 and 1999, respectively. He received his bachelor's degree in horticulture from Michigan State in 1996.

MAES Forestry Scientist, Student Win Best Paper

MAES researchers have taken a close look at the wood and plastic goo that goes into making today's wood substitute building materials. What they learned might soon improve the durability, safety and price of everything from backyard decks to window blinds.

The scientists, MAES forestry researcher Laurent Matuana and doctoral student Bhavesh Shah, studied how various recipes of chemicals and wood particles affect the finished quality of increasingly common wood/plastic composites. Matuana and Shah presented their results at the May 2004 Society of Plastics Engineers annual conference in Chicago, where Shah won the best student paper award in the society's vinyl division. The paper was published in the September issue of the *Journal of Vinyl & Additive Technology*.

Interest in wood/plastic composites is on the rise because of new Environmental Protection Agency (EPA) regulations on pressure-treated wood. As of Dec. 30, 2003, the once common chromated copper arsenate, or CCA, can no longer be used to treat wood that's used near homes. EPA regulators are concerned that arsenic in CCA, which slowly seeps from wood over time, may pose health risks. Children, especially, could be at risk because they spend more time outside than adults do and more frequently put unwashed hands into their mouths.

"Currently, there are 45 companies producing wood/plastic composites (WPCs) in North America, and almost 12 percent of this production takes place in Michigan," Matuana said. "One of the biggest producers of WPCs, CertainTeed Corp., is located in Jackson."

Rick and Karen Batora
DaisyDell Farm and Market
5556 East M-21
St. Johns, MI 48879
989-834-2400
erbatora@mutualdata.com

Bob Boehm
Manager
Commodity and Marketing Department
Michigan Farm Bureau
7373 West Saginaw Highway
P.O. Box 30960
Lansing, MI 48909-8460
517-323-7000

Don Coe
Black Star Farms
10844 East Revold Road
Suttons Bay, MI 49682
231-271-4884
info@blackstarfarms.com

Keith Creagh
Deputy Director
Michigan Department of Agriculture
P.O. Box 30017
Lansing, MI 48909
517-335-3402

Jim Hancock
Professor of Horticulture
A342 Plant and Soil Sciences Building, MSU
517-355-5191, ext. 387
hancock@msu.edu

Joe Herman
Karma Vista Winery
6991 Ryno Road
Coloma, MI 49038
269-468-9463
info@karmavista.com

Stan Howell
Professor of Horticulture
A40 Plant and Soil Sciences Building, MSU
517-355-5191, ext. 311
howell@msu.edu

Jim Ireland
Professor of Animal Science
1230C Anthony Hall, MSU
517-432-1384
ireland@msu.edu

Linda Jones
Executive Director
Michigan Grape and Wine Industry Council
P.O. Box 30017
Lansing, MI 48909-7517
517-373-9789

Tom Kalchik
Associate Director
MSU Product Center for Agriculture and Natural Resources
Suite 210 Hannah Building, MSU
517-432-8752
kalchikt@msue.msu.edu

Ralph King
Executive Director
Michigan Coalition of Black Farmers
11000 W. McNichols, Suite 212
Detroit, MI 48221
313-340-1982
mcbf_ccdo@sbcglobal.net

Bill Knudson
Product Marketing Economist
MSU Product Center for Agriculture and Natural Resources
84 Agriculture Hall, MSU
517-355-2176
knudsonw@msu.edu

Phil Korson
President
Cherry Marketing Institute
P.O. Box 30285
Lansing, MI 48909-7785
517-669-4264
pkorson@cherrymkt.org

Ben Kudwa
Executive Director
Michigan Potato Industry Commission
Michigan Carrot Committee
13109 Schavey Road, Suite #7
DeWitt, MI 48820
517-669-8377
ben@mipotato.com

Gene Meylan
Sugar Beet Grower
Kawkawlin, MI
989-798-0401

Dave Miller
St. Julian Wine Company
716 South Kalamazoo St.
Paw Paw, MI 49079
269-657-5568
wines@stjulian.com

Dianne Novak
Project Services Coordinator
MSU Product Center for Agriculture and Natural Resources
Suite 210 Hannah Building, MSU
517-432-8754
novakd@msu.edu

Osman Patel
Visiting Scholar
Department of Animal Science
1230 Anthony Hall, MSU
517-432-1456
patelo@msu.edu

H. Christopher Peterson
Professor of Agricultural Economics and Nowlin Chair of Consumer-Responsive Agriculture;
Director, MSU Product Center for Agriculture and Natural Resources
83 Agriculture Hall, MSU
517-355-1813
peters17@msu.edu

Steve Poindexter
MSUE Sugar Beet Agent
Saginaw County Extension
1 Tuscola Street, Suite 100
Saginaw, MI 48607
989-758-2500
poindex2@msu.edu

Annemiek Schilder
Assistant Professor of Plant Pathology
104 CIPS, MSU
517-355-0483
schilder@msu.edu

Mike Score
MSUE Agricultural Agent
Washtenaw County Extension
705 North Zeeb Road
P.O. Box 8645
Ann Arbor, MI 48107
734-997-1678
scorem@msue.msu.edu

George W. Smith
Associate Professor of Animal Science
1230D Anthony Hall, MSU
517-432-5401
smithge7@msu.edu

John Spero
Sugar Beet Grower
Birch Run, MI
989-777-2757

109 Agriculture Hall
Michigan State University
East Lansing, MI 48824

ADDRESS SERVICE REQUESTED

NONPROFIT
ORGANIZATION
U.S. POSTAGE
PAID
GRAND RAPIDS, MI
PERMIT NO. 1

12-04 5 M