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MICHIGAN AGRICULTURAL EXPERIMENT STATION

WINTER 2007
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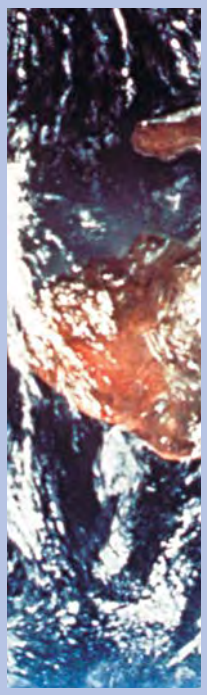
MAES Research: Global Scope, Local Impact

looking into futures



Boldly Going Global

With the click of a mouse, someone in China or Australia can order dried cherries, wine, cheese or maple syrup from Michigan. The burgeoning global community seems to be most apparent in business, especially the business of agriculture. There are hazards associated with global agriculture — diseases and invasive species are only two of the threats — but there are also almost limitless opportunities for new markets, new knowledge and new technology.

MAES Director Steve Pueppke pointed out that globalization affects almost every aspect of agriculture, from the types of crops grown to how they're processed, marketed, packaged and shipped.

"Globalization has created options for Michigan to produce and distribute new kinds of products that were not available a decade or two ago," Pueppke said.

The Michigan Agricultural Experiment Station has a long history of encouraging and sponsoring global research collaborations. Research partnerships between MAES scientists and researchers in other countries bring new knowledge and technology to Michigan and enrich work done at the university.

In this issue of *Futures*, you can read about MAES scientists from a range of disciplines who are collaborating with researchers around the world on work that will enhance Michigan's economy and environment and the quality of life of the state's residents.

Dave Douches, MAES potato breeder and genetic scientist, has participated in research partnerships with scientists from Egypt, Indonesia and South Africa and is exploring collaborations with Chinese researchers (China is the world's No. 1 potato grower). His aim is to develop potato varieties that are high quality, high yielding, and resistant to a number of diseases and insects. Michigan potato breeders have been able to participate in some of the international exchanges that Douches' research has fostered.

MAES animal scientists Cathy Ernst and Jeanne Burton use functional genomics and genomewide genetic approaches to study meat quality, reproduction and health, and they are partnering with scientists around the world to solve problems faced by people and animals.

Russ Freed, MAES canola breeder, also served as director of PFID-Fruits and Vegetables, a program that works to open up markets for smaller farmers from a range of countries, including Nicaragua, Zambia and India. In the process, the program has helped introduce Michigan agribusinesses to markets and cooperative opportunities in these countries.

MAES scientist Kris Berglund works extensively with scientists at the Luleå University of Technology in Sweden. Berglund sees parallels between Michigan and Sweden and thinks the state could use some of the innovative Swedish approaches to push the transition to a bioeconomy.

In his 35-plus-year career, MAES soil biophysics scientist Alvin Smucker has collaborated with researchers from more than 20 countries. As he works to increase the amount of carbon that can be captured and held by soil, Smucker has developed analytical tools that have enhanced MSU's global reputation.

We hope you enjoy this issue of *Futures* and that it helps you understand a little more about the Michigan Agricultural Experiment Station and the research it funds. If you have comments about this issue or would like to subscribe (it's free!), send a note to *Futures* Editor, 109 Agriculture Hall, Michigan State University, East Lansing, MI 48824-1039, or send an e-mail to depolo@msu.edu. You can also call 517-355-0123.

For the latest information about MAES research and events, 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. You also can view this and past issues of *Futures* on the Web site by clicking on the "research publications" tab.

::: Jamie DePolo

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MICHIGAN STATE UNIVERSITY

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Ian Gray, vice president for research and graduate studies and former MAES director, welcomes Gov. Jennifer Granholm at the beginning of her tour of MSU research labs. Both Gray and Granholm view global interaction as critical to Michigan's future.

"Michigan cannot participate in a global economy if our citizens do not have an understanding of the global workplace and the opportunity to interact with educational systems in countries other than our own. More and more, our economy extends beyond our national borders."

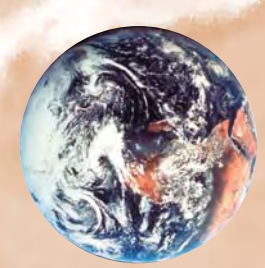
—Gov. Jennifer Granholm

With the advent of the Internet, trade agreements and the idea that there are about six degrees of separation between any two people in the world, the global community continues to coalesce. This is most apparent in business, especially the business of agriculture. Though there are certainly some hazards involved with global agriculture — invasive species and diseases are just a few — there are also many opportunities: new markets, new knowledge, new technologies.

"We need to be globally aware and engaged because globalization affects almost every aspect of agriculture," said Steve Pueppke, director of the Michigan Agricultural Experiment Station. Pueppke's views are well-informed. Before joining Michigan State, he directed Global Connect as associate dean for research in the College of Agricultural, Consumer and Environmental Sciences at the University of Illinois. Global Connect is an initiative focused on the globalization of the college's academic, research and out-

Boldly Going Global

Collaborations with the best minds from around the world enrich Michigan



MAES Director Steve Pueppke *(center)* visits the Institute for Tea Science at Zhejiang University with the director of international programs at Zhejiang University *(left)* and John Santas, of the University of Illinois *(right)*.

PHOTO COURTESY OF STEVE PUEPPKE

reach programs. Pueppke also has been a visiting professor at universities in Switzerland and Germany. "Globalization has greatly enriched our food options at the grocery store and in restaurants," he continued. "This has created options for Michigan to produce and distribute new kinds of products that were not available a decade or two ago. Even if we choose to ignore these opportunities or hazards, they're not going to go away. At MSU and in the MAES, we're capitalizing on the opportunities and mitigating the hazards."

The Michigan Agricultural Experiment Station has a long history of encouraging and sponsoring global research collaborations. The land-grant mission charges institutions with providing solutions to the problems of the people in their states. To do this, the MAES generates knowledge through strategic research to enhance agriculture, natural resources, and families and communities in Michigan. Research partnerships between MAES scientists and scientists in other countries bring new knowledge and technology to Michigan and enrich work being done at the university. As part of her "Boldness by Design" strategic plan, MSU President Lou Anna K. Simon has called for MSU to redefine itself as a land-grant university for the 21st century — to become a "global-grant" university, speeding the transla-

tion of basic discoveries into effects that can be felt in mid-Michigan, across the nation and around the world.

"President's Simon's concept of global-grant perfectly positions MSU and the MAES for the future," Pueppke said. "There will be increasing demand for researchers who are globally sophisticated. In fact, it will become a requirement. The institutions that address this opportunity seriously will have a competitive advantage in placing their graduates and securing research funding."

> "I think we'll see a world where the barriers to the flow of information, goods and people will be much lower than in the past. And this will be beneficial for everyone."

"We want to be the leading land-grant institution. To do that, we need to make the leap to global-grant," said Ian Gray, MSU vice president for research and graduate studies and former MAES director. "We've always had international research, but the idea of global-grant is a more formalized approach. The MAES has a major commitment to international research — it's absolutely key for the entire university to embrace the concept. Our scientists will have more opportunities to engage in scholarly activities that enhance MSU and really make a difference in Michigan and in the world."

Historically, the MAES has served as a catalyst for multidisciplinary research across campus, encouraging scientists from various departments to work together to solve problems facing Michigan. Global collaboration just adds new faces and cultures to this commitment to serve and help the state.

A Two-way Dialogue

Put simply, the MAES wants to bring the best new ideas and technology to Michigan and put them to use to help people. It also wants to help people wherever they are in the world. This exchange benefits both the state and the countries to which MAES scientists travel. For example, as MAES researchers work to drive the state's transition to a bio-based economy, global research collaborations will be imperative.

"Brazil has a much better developed bioethanol industry — all the way from production to distribution to flex-fuel vehicles," Pueppke said. "Europe is ahead of us with regard to biodiesel, and governments there are moving ahead aggressively on making biofuels from cellulose. Global partnerships help us to understand why these countries are where they are and to make more informed decisions about our future directions."

Research that spans the globe also enhances MSU's reputation and attracts top international scholars to the university, both as students and as educators and researchers. It also serves as a showcase for Michigan agricultural goods and services, creating market opportunities for the state's producers and processors. In 2005, Michigan's agricultural exports were valued at $961 million, according to statistics from the U.S. Department of Agriculture Foreign Agricultural Service.

"We're looking at a global economy, one that is becoming more and more global all the time," said Dan Clay, director of the Institute of International Agriculture (IIA). "One of the things MSU does best is to help our stakeholders build alliances. We help them understand international markets and trade. This is imperative if the state is going to be competitive in the global marketplace."

The IIA is home to many of the university's externally funded international development projects, including the Partnership to Enhance Agriculture in Rwanda through Linkages (PEARL), which helped develop One Thousand Hills Custom Roast Rwanda Coffee, available through the MSU online store, and the Bean/Cowpea Collaborative Research Support Program (CRSP), which has enriched diets in Africa, Latin America and the Caribbean. Almost all IIA work involves research, consulting, education and training that will improve the collaborating country, by reducing poverty and increasing food quantity and quality.

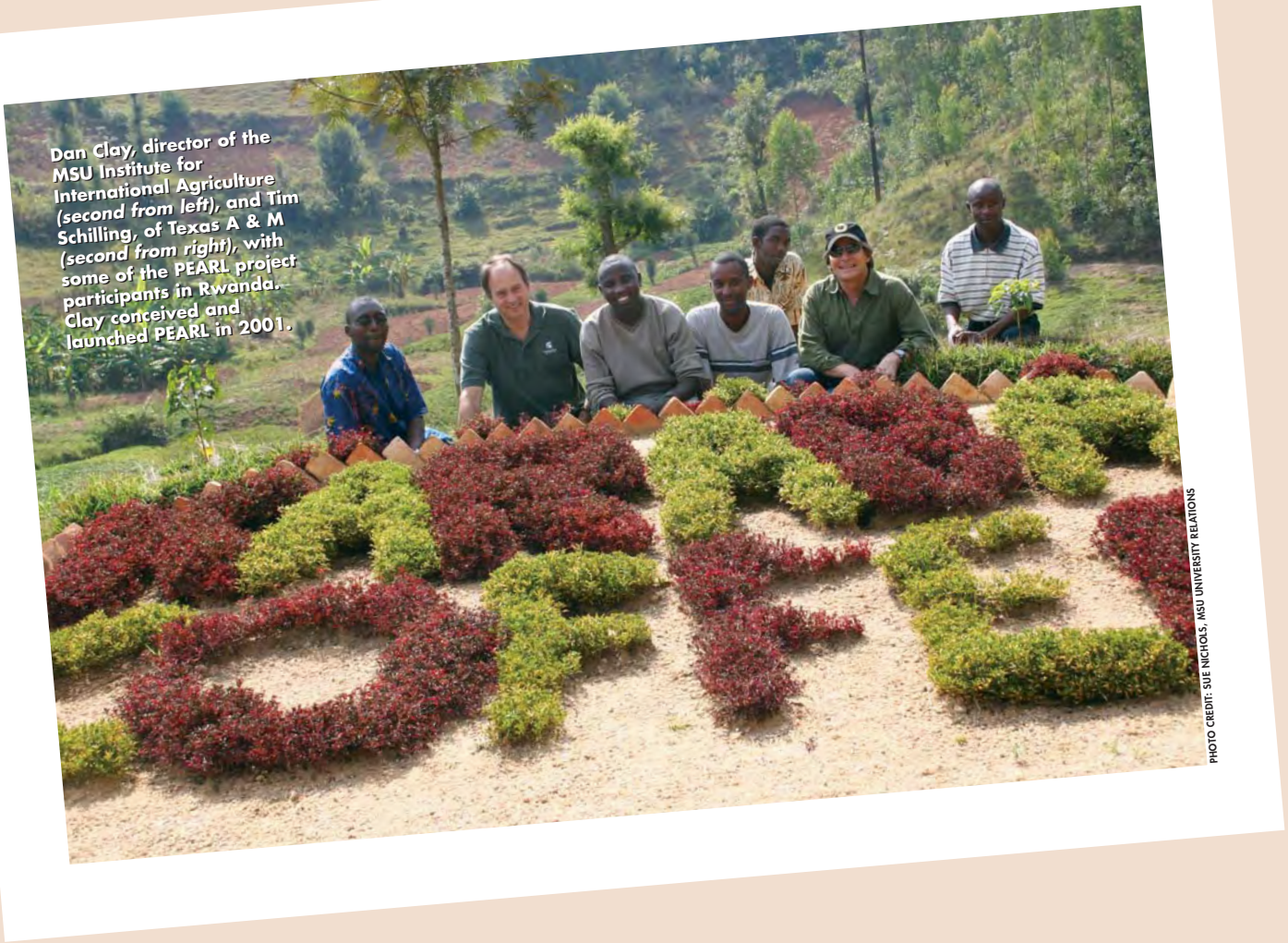
"When you're looking at solving big problems, poverty and hunger are two of the biggest," Clay said. "That's what universities do — they enhance and transform lives. It's a good feeling to be part of an organization that is doing good things."

In the long run, enhancing the standard of living in developing countries will provide dividends to the United States and, ultimately, to Michigan.

"In addition to doing the good work of improving the lives of impoverished people around the world and exposing Michigan stakeholders to global markets, these programs contribute to the growth and rising income levels in developing countries," Clay explained. "And as their income grows, their participation in markets grows, and they become markets for Michigan commodities themselves. The more we improve the welfare of the world, the more markets there are for the United States and Michigan to participate in."

IIA programs also have tangible benefits specifically for Michigan growers and processors.

"Michigan bean growers are huge supporters of the CRSP," Clay said. "This project is an excellent



Dan Clay, director of the MSU Institute for International Agriculture (second from left), and Tim Schilling, of Texas A & M (second from right), with some of the PEARL project participants in Rwanda. Clay conceived and launched PEARL in 2001.

PHOTO CREDIT: SUE NICHOLS, MSU UNIVERSITY RELATIONS

example of direct benefits to Michigan growers."

"Of all the U.S. Agency for International Development-funded programs at MSU, I would say the CRSP truly brings benefits to Michigan," said Irv Widders, MAES horticultural researcher and CRSP director. "CRSP is the backbone of dry bean research, and the Michigan bean industry is enormously supportive. There are companies that have no interest at all in foreign markets that are staunch supporters of CRSP. They recognize the value of the research being done."

CRSP collaborative research focuses on two main areas: dry bean breeding and genetics, including germ plasm exchanges between MSU and collaborating foreign institutions, and nutritional information on dry beans. Michigan growers are especially interested in research that documents the health benefits of dry beans. If these benefits are scientifically proven, they give beans a competitive advantage over other food products, both in the United States and around the world. CRSP research by MAES food science and human nutrition researcher Maurice Bennink has found that regular consumption of beans (about three to four times weekly) can reduce the risk of colon cancer up to 50 percent. Bennink's research has also shown that beans are a good source of high quality protein and can have a protective effect for several chronic diseases, including cardiovascular disease, type 2 diabetes, obesity and certain cancers.

"The CRSP has a very strong relationship with the Michigan bean industry, as well as growers around the country," Widders said. "Because of the CRSP, MSU is known as one of the top places for dry bean research in the world."

"We've seen direct benefits to our industry from the CRSP," said Bob Green, executive director of the Michigan Bean Commission. "The research has used results from around the world to create improved varieties. The project, and Dr. Widders in particular, has helped us get grants to fund research on beans and nutrition. It's definitely helped us."

All of which reinforces Pueppke's vision of the future of global research partnerships in the MAES.

"As our collaborations continue to grow and produce greater benefits, the distinctions between 'us' here and 'them' there will fade away," Pueppke said. "I think we'll see a world where the barriers to the flow of information, goods and people will be much lower than in the past. And this will be beneficial for everyone because we can all take advantage of the best resources available."

::: Jamie DePolo

A Tuber with International Impact

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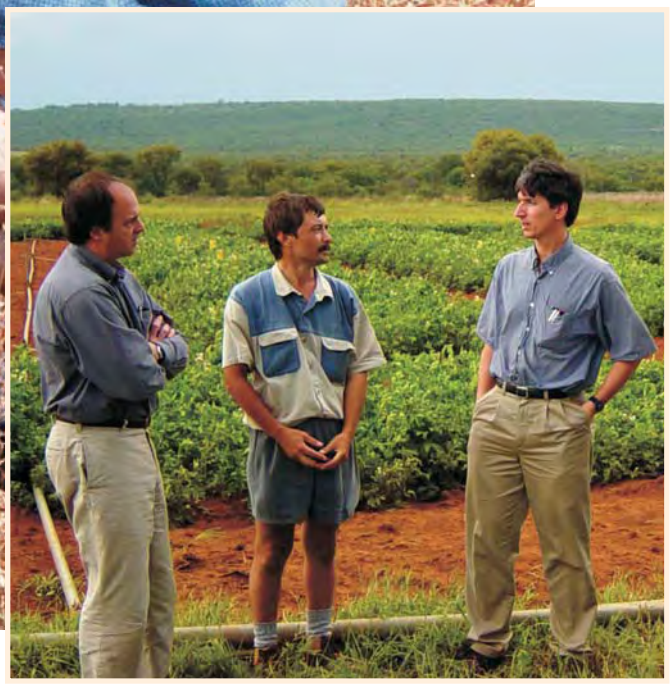


Large picture: MAES scientist Dave Douches *(right)* and Diedrich Visser, entomologist at ARC South Africa, examine tubers in a Bt potato field trial in Roodeplaat, South Africa. Left inset: Karim Maredia *(left)*, MSU professor of entomology who is part of the Bt potato project team, and Douches visit the Bt potato trial in Ceres, in the Western Cape of South Africa. Right inset: Dan Clay *(left)*, director of the MSU Institute of International Agriculture, discusses potato research with Visser and Douches in the fields at Roodeplaat, South Africa.

As the world's No. 4 food crop, the humble potato nourishes people from Ecuador to South Africa and all points in between. MAES researcher Dave Douches has collaborative projects with researchers around the world to keep Michigan's potato industry thriving.

It's been worshipped as a god, banned from the English court and responsible for major population shifts in Europe. Consider the power of the potato:

- In 500 B.C., the Incas worshipped the potato as a type of deity.
- In 1589, legend has it that Sir Walter Raleigh gave Queen Elizabeth I a potato plant as a gift. The queen hosted a banquet for the court with a menu featuring potatoes. But the cooks — unfamiliar with the vegetable — threw out the tubers and served the boiled leaves and stems instead. Since these parts of the plant are poisonous, everyone became deathly ill. Potatoes were banned from the court.
- Between 1846 and 1850, the Irish potato famine halved the population of Ireland and set in motion a mass emigration of starving Irish to the rest of Europe and North America.
- Potatoes produce more nutritious food faster and on less land than any other food crop in almost any habitat. Potatoes provide all the vital nutrients people need except calcium and vitamins A and D. Combining potatoes with milk gives the human body every nutrient it needs.
- In 1992, Vice President Dan Quayle added an "e" to the end of "potato" while visiting a sixth-grade spelling bee, cementing his legacy as a political joke.
- The United Nations General Assembly has declared 2008 to be the International Year of the Potato, a designation it hopes will focus world attention on the role that the potato can play in providing food security and alleviating poverty and hunger.

Michigan is the country's 10th largest potato grower, producing almost 14 million hundredweight in 2005, according the National Agricultural Statistics Service.

Potatoes added almost $110 million to the state's economy in 2005. Around the world, the United States ranks fifth in potato production, behind China, the Russian Federation, India and the Ukraine. Germany, Poland, Belarus, the Netherlands and France round out the top 10.

"Everybody in the world eats potatoes," said Dave Douches, MAES potato breeder and genetic scientist. "And almost every country in the world studies potatoes."

Douches' aim as a breeder is to create varieties that have high yield potential, good appearance, excellent processing qualities (for chip and frozen processing), bruising tolerance and pest resistance, including resistance to the Colorado potato beetle, pitted scab, late blight, potato early die, tuber rot and storage diseases — Fusarium dry rot, Erwinia soft rot and late blight. Because potatoes are not native to North America (evidence suggests that potatoes originated somewhere between Peru and Bolivia), Douches has developed a number of international collaborations to exchange genetic material and information.

Dave Douches displays tubes of disease- and virus-free tissue culture plants in his potato advanced breeding lines. The university's potato breeding program has sent MSU lines to other countries through tissue culture to satisfy government phytosanitary requirements on importing potatoes.

PHOTO COURTESY OF DAVE DOUCHES

Douches was invited to China to discuss breeding potatoes that are resistant to late blight. In the Hunan Province countryside, most available land is used for food production.

"Potatoes have a narrow genetic base and reproduce asexually, so it's difficult to introduce desirable traits, such as pest resistance, by conventional breeding," he explained. "In 1992, we started working with researchers in several developing countries, including Egypt and Indonesia, through the ABSP [Agricultural Biotechnology Support Project] to develop transgenic potatoes resistant to potato tuber moths."

The potato tuber moth is the most serious potato pest worldwide. The moth damages growing plants in the field by feasting on leaves and can reduce yield by 30 percent. Moth eggs and larvae in harvested potatoes can infest storage facilities. Infested stored potatoes are then likely to succumb to bacterial infection, which makes them unfit to eat or use as seed. Small farm storage facilities can see an entire crop wiped out by the moth. Insecticides are available to control the moth, but they're highly toxic and expensive to use.

"Though we don't have potato tuber moths in Michigan, we do have Colorado potato beetles, which are a severe problem for us," Douches explained. "Also, tuber moths are becoming an emerging problem in the Pacific Northwest. The process of getting insect resistance into a plant is the same, no matter what insect you're trying to fight. The breeder and the entomologist gain from looking at the interaction between the plant and more than one insect. So the expertise we're developing here will cross over to other areas and has definite benefits for Michigan potato growers."

Taking on a Worldwide Tuber Pest

Funded by the U.S. Agency for International Development (USAID), ABSP sought to reduce poverty and hunger through agricultural biotechnology by developing expertise in research, policy development, licensing and outreach in developing countries. Its scope included corn and cucurbits as well as potatoes. Douches found that genes from the natural soil bacterium *Bacillus thuringiensis* (Bt) could be introduced into potato plants. The Bt genes then protected the potato plants from the tuber moths. Approved for use by organic growers, Bt has been used to kill insects for about 30 years. It affects only specific pest insects and is harmless to people, birds, animals and beneficial insects. Ultimately two lines of Bt Spunta potatoes (as the tuber moth-resistant varieties were named) with commercial potential were identified.

When the funding for the original ABSP project ended, Douches began working with researchers in South Africa who were also interested in the tuber-moth-resistant potatoes. The Spunta lines were field tested in Egypt and South Africa. The collaboration with South Africa became its own funded project, and in 2003, Douches and his collaborators at the Roodeplaat Vegetable and Ornamental Plant Institute in Pretoria began collecting the necessary data for commercial approval of a Spunta variety in South Africa.

PHOTO COURTESY OF DAVE DOUCHES

While in China, Douches visited the potato breeding program at the Chinese Academy of Agriculture Sciences in Beijing. Liping Jin *(right)*, Chinese potato researcher, shows the greenhouse containing plants for the breeding program to M.S. Ramana, potato cytogeneticist from the Netherlands.

Because the Bt Spunta potatoes are transgenic — they have a gene from another organism inserted into them — extensive regulatory and safety data must be gathered and evaluated before the crop can be released commercially to growers.

"Our goal is to deregulate a transgenic Bt potato variety in South Africa and then release an insect-resistant variety through the public sector," Douches continued. "This is a long-term project — you can't just start and stop it. We've been working on it in some form since 1992. There are a lot of steps that have to be followed, and they need to be done in a specific way. This research is helping both South Africa and MSU build the infrastructure and capacity to deregulate a transgenic crop. In a sense, our team of researchers, which includes experts in breeding, entomology, socioeconomics, communications and regulatory requirements, is building a 'deregulation package' that can be used for other crops and projects."

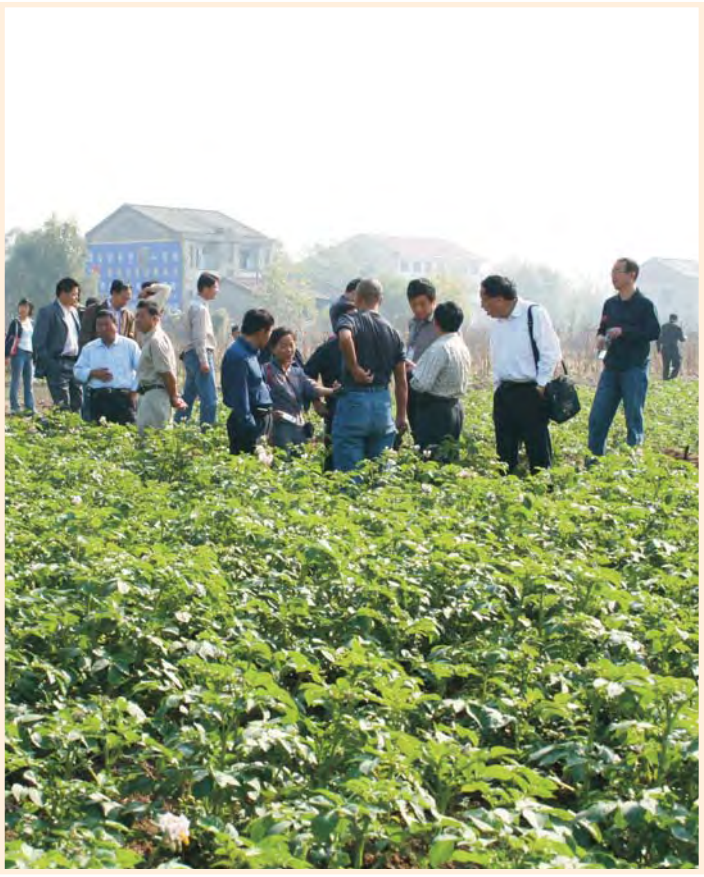


PHOTO COURTESY OF DAVE DOUCHES

Chinese potato scientists visit a commercial potato field in the Hunan Province of China. Potatoes are being double-cropped with rice to maximize the food production capacity of the land. China is the world's top potato-producing country, with almost 10 times more land in potato production than the United States.

Other MSU researchers working on the project are Johan Brink, director of biotechnology programs in the MSU Institute of International Agriculture (IIA); Hector Quemada, IIA visiting associate professor; Karim Maredia, IIA short course programs director, who also coordinates the Borlaug Fellowship Program at MSU; Kelly Zarka, molecular research technician in Douches' lab; and Walter Pett, assistant professor of entomology.

According to Douches, the Spunta potato lines offer growers safe, economic control of potato tuber moths, reduce insecticide use in the field, and reduce or eliminate insecticide use on potatoes in storage.

"We've run field trials in the United States, Egypt and South Africa," Douches explained. "Our results showed complete control of potato tuber moth in Egypt and South Africa. There were no infestations in the leaves and tubers in the field and no infestation in storage. The benefits of Bt potatoes to farmers and consumers will be reduced input costs (less insecticide used),

Borlaug Fellowship Program Helps Train Global Scholars

The Norman E. Borlaug International Agricultural Science and Technology Fellows Program helps developing countries enhance their sustainable agriculture practices by providing short-term scientific training and collaborative research opportunities to researchers, policy-makers and university faculty members. These visiting scholars from developing countries work with mentors at land-grant universities and 1890 colleges, government agencies, international research centers, and other nonprofit institutions and private companies. Douches has hosted several Borlaug scholars in his potato breeding and genetics lab.

The Borlaug Fellowship Program started in 2004 in honor of Norman Borlaug, who won the Nobel Peace Prize in 1970 for his success in developing high-yielding wheat varieties and reversing severe food shortages in India and Pakistan. Credited with saving millions of lives, his work helped eliminate recurring famines in South Asia and helped global food production outpace population growth.

The program is open to participants worldwide but focuses on African, South and Central American, and Asian nations. The program is administered by the Foreign Agricultural Service in cooperation with USAID and the U.S. State Department.

increased marketable yield, improved quality, reduced postharvest losses, reduced human exposure to pesticides and less pesticide residue on potato tubers."

Michigan Potato Industry Sees Benefits

The Michigan potato industry is a strong supporter of Douches' research, and industry representatives have participated in some of the international exchanges the research has fostered.

PHOTO COURTESY OF DAVE DOUCHES

At the end of their trip, MAES scientist Dave Douches and Dutch scientist M.S. Ramana *(third and second from right, respectively)* attended a Chinese banquet hosted by Dongyu Qu *(third from left)*, vice president of the Chinese Academy of Agriculture Sciences.

"These international collaborations have given Michigan potato growers the opportunity to interact with researchers and growers from other countries," Douches said. "They become part of the global university."

Through Douches' research partnerships, which bring international scientists and growers to the state, Michigan growers have met and interacted with South African potato growers and industry representatives, as well as potato growers from Madagascar. Michigan potato growers also attended the World Potato Conference in 2006.

"Dave is running a major research program with many components, including teaching, basic research, applied research and variety development," said Ben Kudwa, executive director of the Michigan Potato Industry Commission. "Michigan growers know the value of having a comprehensive program like this in Michigan. You always learn something from interactions with growers from other countries. This research has benefits for Michigan growers."

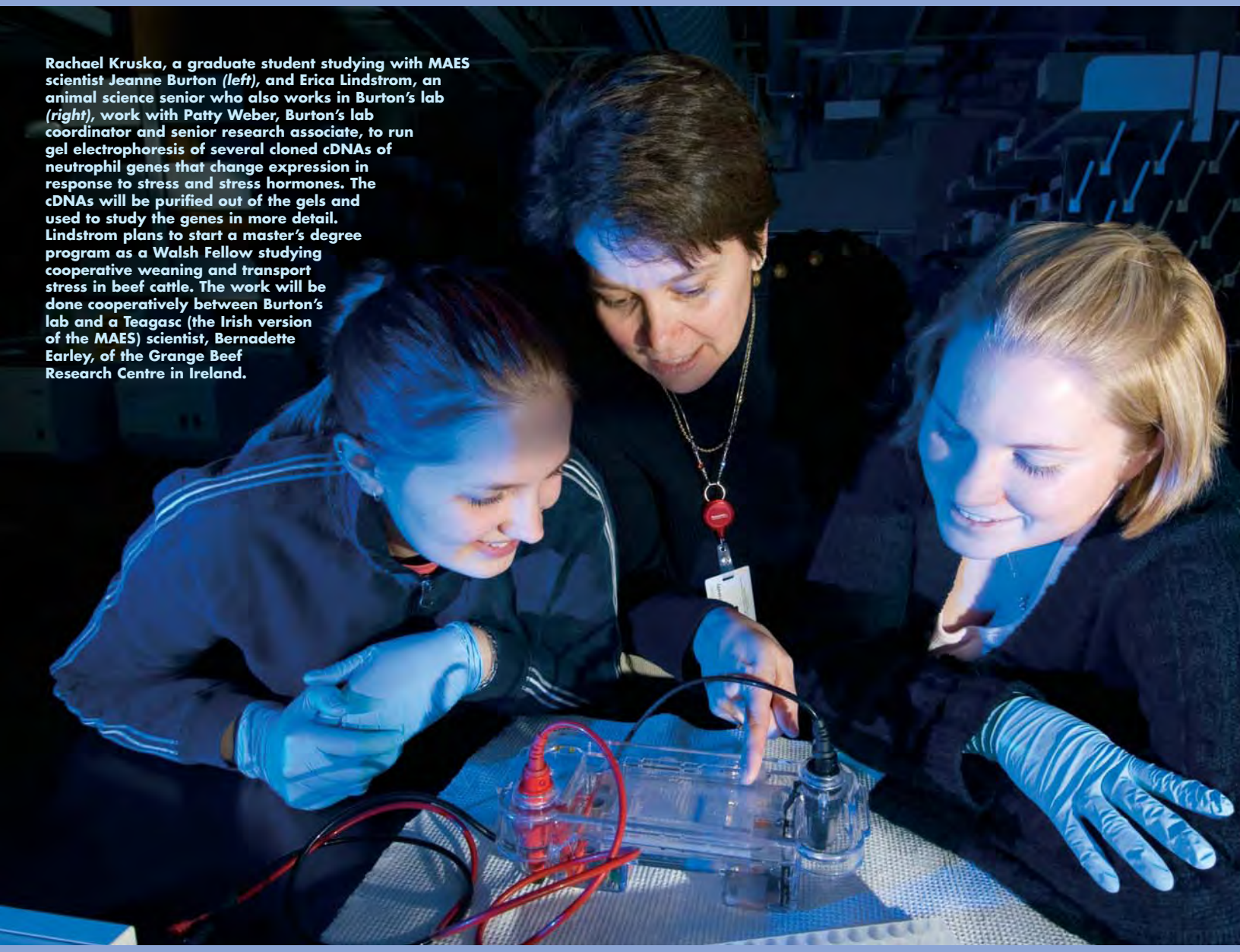
Kudwa said that Michigan potato growers are also very interested in the deregulation package that Douches and the Bt potato team are creating for South Africa. Though not directly involved, he said the industry is interested in the infrastructure associated with the approval process for genetically modified potatoes, as well as how these potatoes would be accepted in Michigan.

"This technology could be very beneficial to Michigan potato growers, to the environment and to the economy," Kudwa said. "But we have to know if Michigan consumers would accept a product like this."

Douches' global partnerships and interactions with foreign industry officials also open doors for further discussions about exporting Michigan potatoes to other countries.

"We're intrigued by the exploratory visit Dr. Douches has made to China," Kudwa said. "China is the No. 1 producer of potatoes in the world, but you don't think of China as a potato producer. And there are more than 1.3 billion people in China. The logistics of supplying that many people with a consistent food supply are mind-boggling. It's difficult for us to export Michigan potatoes because of our location in the center of the United States. But we'd be foolish to ignore 1.3 billion consumers. As I said, there are many components to this research. And there is definitely something for Michigan potato growers in it."

::: Jamie DePolo



Rachael Kruska, a graduate student studying with MAES scientist Jeanne Burton *(left)*, and Erica Lindstrom, an animal science senior who also works in Burton's lab *(right)*, work with Patty Weber, Burton's lab coordinator and senior research associate, to run gel electrophoresis of several cloned cDNAs of neutrophil genes that change expression in response to stress and stress hormones. The cDNAs will be purified out of the gels and used to study the genes in more detail. Lindstrom plans to start a master's degree program as a Walsh Fellow studying cooperative weaning and transport stress in beef cattle. The work will be done cooperatively between Burton's lab and a Teagasc (the Irish version of the MAES) scientist, Bernadette Earley, of the Grange Beef Research Centre in Ireland.

Michigan State has a growing international reputation in animal genetics. Michigan Agricultural Experiment Station scientists using functional genomics and genomewide genetic approaches to study meat quality, reproduction and health are partnering with scientists around the world to solve problems faced by people and animals.

Animal Genetics Go Global

Which Genes Make Meat Mouth-watering?

The words for beef and pork vary from language to language, but the response to a succulent piece of meat, perfectly prepared, is practically universal: "Mmmmmmm."

Animal producers, however, are at somewhat of a disadvantage in rearing cattle and pigs that have consistently high quality meat year after year. Right now, quality can't truly be determined until after the animal is slaughtered and the cuts of meat are graded. Farmers extrapolate ideas about meat quality based on the animal's appearance,

MAES animal scientist Cathy Ernst studies the molecular genetics of pigs and beef cattle to identify the genes responsible for meat quality. Though various countries have different desired characteristics for meat, issues relating to quality exist around the world. Ernst says international collaborations make her work progress faster.

size and other characteristics; animals thought to have high meat quality are bred to continue those positive traits in the herd. Animals thought to have lower quality are not used for breeding.

"Ultimately, meat quality is an end-of-life issue," said Cathy Ernst, MAES animal science researcher. "If desirable traits are found after slaughter, it's too late to use that animal in the breeding herd and pass those traits on to the next generation."

Ernst studies the molecular genetics of pigs and beef cattle, seeking to parse out the suite of genes responsible for controlling meat quality. In her experiments, she looks at the genetic makeup of animals with outstanding meat quality and then compares that DNA with DNA from other animals with outstanding quality to identify common genes. Ultimately, she would like to offer producers a simple blood test for meat quality. Once the genes are identified, DNA could be extracted from an animal's blood sample and the genetic information would predict meat quality long before slaughter. This would allow producers to make much more informed decisions about breeding and culling.

Though the pig genome isn't completely sequenced yet (Ernst expects that a draft sequence will be done by the end of 2007), scientists believe it will be similar in size to the human genome — about 3 billion base pairs. The bovine genome sequencing is done, and it, too, is similar in size to the human genome. Because there are so many genes to look at, international collaborations are invaluable to Ernst's research.

"My first international collaboration was with scientists in Ireland," she said. "We exchanged bovine DNA, and my Irish colleagues sent a graduate student to my lab for training. The more DNA samples we can use to validate our work, the better and more reliable results we have. Scientists around the world looking at this topic want to work together. We all have the same goal of high quality meat."

While various cultures have different desired characteristics for meat, issues relating to quality exist around the world. Some cultures prefer very lean meat; others like meat that has more fat and is well-marbled. What's important to producers is providing the meat quality desired by consumers and providing it consistently.

"Consumer preferences may differ, but the genes controlling the traits are in most instances the same," Ernst explained. "We'll just be targeting different allelic variants for those genes."

Ernst said traits involved in high quality meat include:

- Flavor and juiciness, which are related to water-holding capacity and the quantity of intramuscular fat (marbling).
- Tenderness, which is influenced by protein breakdown, connective tissue characteristics and other factors.

Producers also want animals that have good growth rates and reproductive performance, traits controlled by different genes.

"All these desired traits have to be considered in a production system," Ernst said. "Raising animals with these traits has to be economically viable for producers."

PHOTO COURTESY OF CATHY ERNST

Ernst expects that a draft sequence of the pig genome will be available by the end of 2007. The pig genome will be similar in size to the human genome.

Recently, Ernst has worked with scientists from Korea, Brazil and Thailand on pork quality and is investigating a potential collaboration with Chinese pig researchers. In addition, Ernst and MAES animal scientist Ron Bates have collabo-

rations with Swedish and German pork researchers. As MSU's reputation grows in this area, scientists who don't have the capability to conduct molecular genetics research look for opportunities to come to East Lansing for training. In 2007, Ernst is planning to host two African scientists for training visits.

International trade and marketing of meat products is extremely important in a global economy. Collaborations not only enhance the research results of Ernst and her international collaborators but also benefit producers in Michigan and each of their respective countries. It is also essential for students to understand marketing and trade issues.

"Even though I am working at a basic research level," Ernst added, "I can bring my international experiences into the classroom to enhance the connection for our students between what we do in livestock and meat production in Michigan and the United States and what is happening in the global marketplace.

"My international experiences have been phenomenal," she continued. "International work has broadened my research perspectives and allowed me to see firsthand how researchers from other countries interact with their industry groups. Our meat quality research could get done without international collaborations, but the collaborations enhance the work and definitely make it progress faster."

Understanding the Genes that Control Animal Health Can Lead to Better Human Health

Researchers have long used animal models to study how the human body reacts at the genetic level to disease, stress, nutritional deficiencies and other ailments. Traditionally, the animals were small — mice, rats and other rodents — because they were easy to handle and shelter. But thanks to work by Michigan Agricultural Experiment Station animal functional genomics scientists, biomedical researchers now are realizing that larger agricultural animals such as dairy cows or pigs may be better models to decode the secrets of human gene function and health.

Functional genomics research identifies the expression and function of thousands of genes and the proteins they encode that underlie the key traits, physiology or development of an organism.

Jeanne Burton, MAES animal science researcher and head of the MSU Immunogenetics Laboratory *(right)*, works with Rachel Kruska, a graduate student in Burton's lab *(seated)*, on a project that seeks to identify the protein networks that regulate gene expression in neutrophils of stressed dairy cattle.

In May 2006, Michigan State hosted the Second International Symposium on Animal Functional Genomics (ISAFG), organized by Jeanne Burton, MAES animal scientist and head of the MSU Immunogenetics Laboratory, and Guilherme Rosa, former MSU assistant professor of animal science, who is now at the University of Wisconsin-Madison. The symposium featured leading functional genomics scientists from around the world. Topics addressed included the study of large gene sets that underlie immune system responses to parasites and environmental and physiological stressors, fertility, growth, and metabolism.

"The Second International Symposium on Animal Functional Genomics was a tremendous success, bringing scientists from around the world to MSU to exchange ideas and present the latest research in an area that is transforming the way animal biology is studied," said Paul Coussens, MAES animal scientist and director of the MSU Center for Animal Functional Genomics. "In addition, it is clear that functional genomics is making domestic species more attractive as biomedical models."

In recognition of the potential for agricultural animals, fish and wild animals to serve as biomedical models, as well as the quality of the research presented at the Second ISAFG, the journal Physiological Genomics published a special issue in December 2006 on animal functional genomics featuring 12 papers that were presented at the symposium.

"Our fellows will have exposure to the best minds in the world. It's wonderful to have this opportunity for our students."

PHOTO COURTESY OF CATHY ERNST

MAES scientist Cathy Ernst *(center)* has collaborated with colleagues Kwan-Suk Kim *(left)* and Jong-Joo Kim *(right)* in South Korea on the molecular genetics of pork quality. Later this year, she will host two African scientists in her lab for training visits.

"High priority human health research areas such as disease susceptibility and pathogenesis, fertility, behavior, obesity, and muscle development could be enhanced by using agricultural species as biomedical models," said Burton, who is also a member of the MSU Center for Animal Functional Genomics. "As we study ways to improve animal health, we also can improve human health. Publication of agricultural animal and aquaculture functional genomics research in topnotch journals such as Physiological Genomics is important because it means biomedical researchers are seeing how valuable this work is.

"We were able to bring the top thought leaders in this discipline together at the symposium, and the program was excellent," Burton continued. "The caliber of the symposium led to the special issue of Physiological Genomics, which is a unique way to share this information with the public."

The special issue is available online at http://physiolgenomics.physiology.org/.

The symposium was supported by the MSU Center for Animal Functional Genomics and a grant from the U.S. Department of Agriculture (USDA) National Research Initiative Genomics Program, as well as by donations from corporate sponsors Applied Biosystems, Beckman Coulter, Fisher Scientific, Genomic Solutions, Invitrogen, Molecular Devices, Operon, Tecan and ArrayIt.

MSU's leadership in animal functional genomics also extends to training future leading scientists. The university recently received a USDA National Needs Fellowship grant to support four graduate doctoral fellowships in animal functional genomics. Coussens is the principal investigator for the grant. Karen Plaut, chairperson of the MSU Department of Animal Science, Burton, and 13 other MSU animal science and veterinary medicine faculty members are co-investigators.

"Dr. Burton's efforts to organize an international meeting on functional genomics and her work with Physiological Genomics to publish an entire issue focusing on the meeting demonstrate her dedication to educating scientists across the nation and the world," Plaut said. "These efforts put the MSU Department of Animal Science in a leadership role and helped secure the National Needs Graduate Fellowship awards."

The U.S. Department of Agriculture National Needs program is funding two fellowships, and the MSU Department of Animal Science and the Michigan Agricultural Experiment Station are funding the other two.

"Functional genomics is making domestic species more attractive as biomedical models, and the Center for Animal Functional Genomics at MSU is very proud to be a part of this effort," Coussens said. "The USDA grant to fund graduate students in the critical areas of bioinformatics and functional genomics will ensure that there is a new generation of scientists familiar with the use of these post-genome sequence tools to enhance both biomedical and agricultural sciences."

"Through the MSU Center for Animal Functional Genomics, there are tremendous international connections," Burton added. "Our fellows will have exposure to the best minds in the world. It's wonderful to have this opportunity for our students."

For more information about the MSU Center for Animal Functional Genomics, visit the Center's Web site at http://cafg.msu.edu.

::: *Jamie DePolo*

A STEADY SUPPLY


PHOTO COURTESY OF RUSS FREED

Global partnerships fostered by MSU help keep fruits and vegetables on store shelves year round.

The last decade has brought changes to the way many people in Michigan buy food and the way some farmers supply food to retailers. As conglomerate stores began carrying food, including fresh fruits and vegetables, they wanted to offer their customers consistent quality and selection. So these large retailers began requiring vendors to guarantee a 12-month supply of the product under contract. To keep their contracts, producers had to figure out how to offer a year-round supply of even the most delicate tropical fruits.

"In the past 10 years, stores began demanding specific sizes, shapes and textures for fruits and vegetables," explained Russ Freed, MAES crop and soil sciences researcher and former director of the Partnerships for Food Industry Development (PFID)-Fruits and Vegetables, a program funded by the U.S. Agency for International Development (USAID) and administered through the MSU Institute of International Agriculture. "Also, many of the big companies require that farmers be able to supply 12 months of a commodity, such as mangoes, bananas, blueberries, whatever. This is having an effect on farmers. To provide a 12-month supply, you need to be a big farmer or a coalition of smaller farmers."

Started in 2001 at MSU, PFID works to increase the competitiveness of small- and medium-scale producers in developing countries around the world. By linking these smaller farmers with local, national and international markets, PFID boosts economic development in the developing countries. The program has the added bonus of creating new business opportunities for Michigan producers and processors.

According to Freed, who was PFID-Fruits and Vegetables director from 2005 to 2006, PFID collaborates with public and private entities to open up markets for smaller farmers from a range of countries, including Nicaragua, Zambia and India. In doing so, it has helped introduce Michigan

MAES scientist Russ Freed led the PFID-Fruits and Vegetables program for 2 years. Some of the program's partners in Nicaragua are *(from left)*: Sebastian Araya, Finca owner; Felipe Lazaro, Finca worker; Freed; Lolita de Araya, Araya's wife; and Alejo Espinoza and Vicente Reyes, of Technoserve. Finca is a microfinance organization that works with farmers in Latin America. Technoserve is a nongovernmental organization that gives technical assistance to the farmers on how to grow their crops.

agribusinesses to markets and cooperative opportunities in these countries. For example, a Michigan spice company has set up a paprika processing plant in Namibia. This ensures that the company has a ready supply of paprika for consumers and also gives Namibian farmers a new market for their product. Other companies have contracted with growers in Central America to supply coffee and bananas and with growers in India for mangoes. PFID does not work with crops that are exported from the United States to avoid any potential conflicts with U.S. exporters.

"I haven't seen a better development project than the one in Nicaragua. It's really having an impact."

"The major activity of PFID is promoting economic development and growth among farmers that are making less than $2 per day," Freed said. "That scenario doesn't fit in with the concept of sustainability, for either people or agriculture. If these farmers are able to expand their operations, they'll have more money and be able to buy more and higher quality food. In turn, this will create new markets in those countries that Michigan growers can fill. Because we work so closely with the farmers, we can introduce people to one another."

Typically, PFID begins helping fruit and vegetable farmers expand local markets by improving infrastructure, such as transportation, communication and production techniques. This leads to higher quality products and increased consumption, which improves the health of the local population. Then the farmers move on to regional and international markets.

A Nicaraguan Success Story

Since 2003, PFID has been helping Nicaraguan fruit and vegetable farmers become more competitive and to increase growers' access to high value markets. PFID scientists designed technical assistance programs tailored to participating producers' needs, with the ultimate goal of helping them consistently and efficiently produce high quality and safe produce for local, regional and export markets. In addition to PFID scientists, the partnership includes the following businesses, agencies and governmental organizations: Hortifruiti and La Colonia supermarket chains, Catholic Relief Services, Technoserve, Adventist Development and Relief Agency, Project Concern International, Save the Children, World Relief Corporation and the Inter–American Institute for Agricultural Cooperation.

Despite some economic improvements, Nicaragua is the second poorest country in the Americas. About half of the population lives in poverty, and 17 percent lives in extreme poverty. About 75 percent of Nicaragua's poor people live in rural areas and depend on agriculture for employment in addition to food. The Nicaraguan government would like to encourage economic growth in rural areas to reduce poverty as well as the potential for political instability.

The Central American Free Trade Agreement (CAFTA) with the United States has forced the Nicaraguan economy to globalize very quickly, which has created both opportunities and threats for Nicaraguan agriculture. For producers who can meet regional and global market standards and then move into these new markets, there are many opportunities. But these producers have to be prepared to meet the inevitable competition that will come because of lower trade barriers.

Phase I of the Nicaraguan project was completed in 2005, and the results were impressive: sales of fruits and vegetables increased by $7.4 million, more than 11,000 jobs were created, and more than 9,000 acres went into production. Twenty-four alliances were formed and 26 market contracts between farmers and buyers were formalized. In addition, six associations improved their business practices. All the results exceeded the targets set by the program.

In addition, about a quarter of the program participants were single mothers and female heads of household. In Nicaragua, women make up about 20 percent of rural workers who don't own any land. Off-farm jobs in transport, packaging and agricultural labor that were created as crops became more diverse and sales of fruits and vegetable increased were important sources of income for these women.

"I haven't seen a better development project than the project in Nicaragua," Freed said. "It's really having an impact. One aspect of the program involves teaching at-risk youth how to grow fruits and vegetables and then how to market them. They're learning that you can make a living without resorting to crime."

To continue the momentum of the project, Phase II started in 2006. PFID scientists continue to provide technical assistance, as well as identify potential buyers and evaluate markets, and help build strong, lasting alliances between buyers and Nicaraguan suppliers. They're also working with public and private organizations to get rid of any supply chain constraints to fresh produce sales.

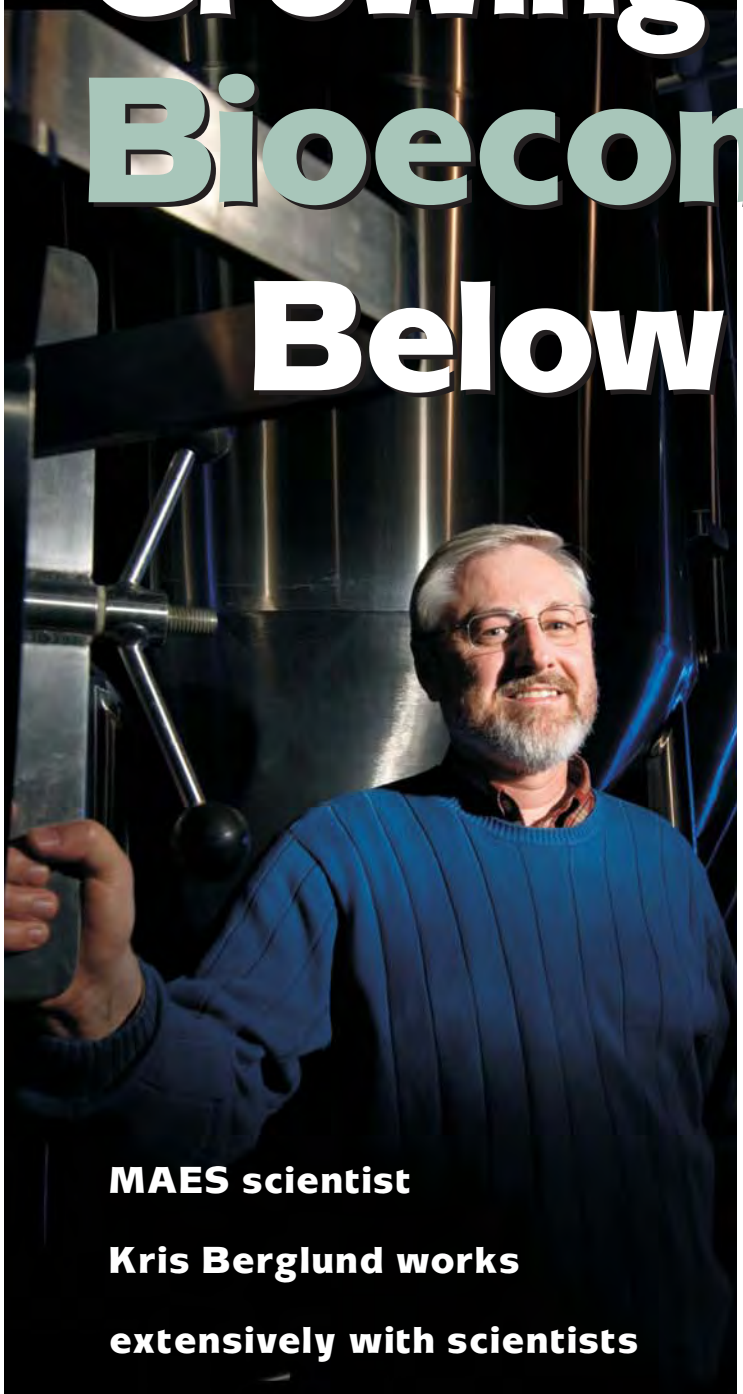
PFID also provides research opportunities for graduate students, some from the United States and some from developing countries.

"Many of our graduate students are studying market intelligence — what's the demand around the world for what can be grown in Nicaragua?" Freed said. "Right now, Nicaragua is the No. 1 exporter of okra into Miami. Honduras and Mexico used to be the biggest exporters of okra, but Nicaragua has done a good job of forming alliances and marketing its okra. Other students are studying the market for a processed banana product.

"I think it's a great program because it allows faculty members to do research within PFID," Freed concluded, "and it also allows them to bring their international experiences to the classroom. Instead of just talking about what's happening in global markets, professors can give their students firsthand experience and details."

::: *Jamie DePolo*

Growing the Bioeconomy Below Zero



MAES scientist Kris Berglund works extensively with scientists at the Luleå University of Technology in Sweden. Can the Swedes' commitment to bio-based products be a model for Michigan?

MAES scientist Kris Berglund presents information on his new company, Working Bugs, at an energy technology and policy forum with Maud Olofsson, Swedish deputy prime minister and minister for enterprise and energy.

Just below the Arctic Circle and 4,500 miles away from East Lansing, Kris Berglund, MAES biochemical processing researcher, is collaborating on products and processes that may play a crucial role in furthering Michigan's bioeconomy.

"Sweden has a national initiative to eliminate all uses of petroleum-based products by 2020 and instead use products made from renewable resources," Berglund explained. "There are parallels between Michigan and Sweden. The population is roughly the same, as is the land mass of each. Also, neither Sweden nor Michigan has large amounts of

Maud Olofsson, Sweden's deputy prime minister and minister for enterprise and energy *(top photo)*, explains key energy policy initiatives in Sweden at the Energy Technology Policy Forum Jan. 9. The forum was sponsored by NextEnergy, a nonprofit corporation founded by the state to accelerate the research, development and commercialization of alternative energy in Michigan. Jim Croce *(center photo, left)* is the CEO of NextEnergy. Part of the forum was aimed at exploring collaborations on alternative energy between Michigan and Sweden.

investment capital. I think Michigan could use some of the innovative approaches that Sweden is developing to really push the transition to a bioeconomy."

Berglund is in a unique position to know. He's helping to develop some of Sweden's innovative approaches to creating bioproducts and processes. In addition to his MSU appointment, Berglund is also a professor in the Department of Biochemical and Chemical Process Engineering, a department he helped found at the Luleå University of Technology (LTU) in Luleå, Sweden. Berglund's collaborations in his family's native land (his grandfather is from a town 9 miles from Luleå) have spawned enterprises in Michigan (in Scottville and Webberville), Sweden and France and raised tantalizing possibilities for diversified biorefineries that crank out bioproducts ranging from fuels to chemicals.

MSU Biotechnology Creates Products from Renewable Resources

Diversified Natural Products (DNP), the Scottville-based company, uses Berglund's research to make new bio-based products. The company has two divisions — bio-based fuels and chemicals, and gourmet and nutritionally enhanced foods. The unifying theme is agriculture-based biotechnology that harnesses readily available natural resources. One of the company's first products is exotic specialty mushrooms, including the elusive morel. This is the first time morels have been mass-produced indoors. Other products that DNP is producing or plans to produce are a sodium-free salt substitute invented at MSU and marketed under the trademark HälsoSalt and a natural cholesterol-lowering product. DNP received a 21st Century Jobs Fund award to produce the cholesterol-lowering product, which is currently on the market in Canada.

DNP's bio-based fuels and chemicals division produces succinic acid from "green" sources. Global demand for succinic acid is enormous — it's used in everything from industrial solvents and biodegradable polymers to airport runway deicers. DNP makes succinic acid from natural sugars derived from sources such as Michigan corn. Fifteen of DNP's patents have sprung from Berglund's research. DNP also has a Swedish subsidiary, and at the beginning of 2007 it announced plans to build a 5,000-ton bio-based succinic acid plant in France.

Working Bugs, the Webberville-based company, is a partnership between Spartan Technology Development, another Berglund company based in East Lansing, and the Michigan Brewing Company, the Webberville beer brewer. As the name implies, Working Bugs identifies microbes that could be used in fermentation processes to make products from renewable resources, as well as intermediate chemicals that are then used to make other bio-based products.

The research to identify potentially useful microbes will be done in Sweden at LTU and the DNP subsidiary. The chemical catalysis and reaction research will be conducted at Michigan State, and the processes will be integrated, validated and commercialized through Working Bugs.

"The microbes will come from a variety of places," Berglund explained. "Once we identify an organism that might work, we have to refine it and scale it up so production is economically viable. When research identifies something we're confident in, Working Bugs will test it on a large scale."

A Diversified Vision for the Bioeconomy

Berglund is also working on producing biofuels and other bioproducts from black liquor, a mixture of lignin and sugar that's a byproduct of paper production. Many paper mills burn black liquor to make steam to power their operation, but Berglund said the paper companies in Sweden are so efficient that they don't need all of the energy produced by black liquor combustion.

Black liquor can also be turned into a gas, which can then be used to make methanol, dimethyl ether and hydrogen. Other paper production byproducts include carbon dioxide and tall oil, an oil from pine trees that is also known as liquid rosin. (The name "tall oil" comes from the Swedish word "tallolja," which means "pine oil.")

This cornucopia of chemicals seems head-spinning, but the ability to connect the dots between them is how Berglund characterizes his talent and how he views the framework for Michigan's bioeconomy.

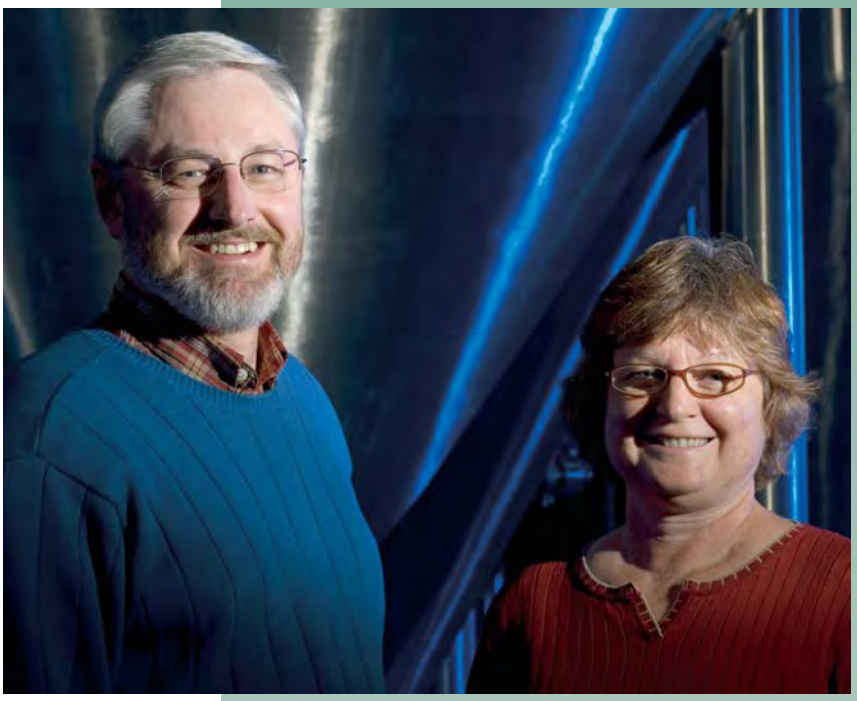
"Carbon dioxide is used in the process to make succinic acid," he explained. "At DNP, we're developing a process that uses waste carbon dioxide to make bio-based succinic acid. Succinic acid can be combined with ethanol to make diethyl succinate, dibutyl succinate and other high-value platform chemicals. The idea is to take one molecule, succinic acid in this case, and have a family tree of chemicals and fuel additives that can be made. My talent is in seeing how all these things fit together."

Designing processing plants that can produce a full complement of bio-based chemicals, fuels and other products results in a diversified operation that isn't subject to the ups and downs of a single market. If the ethanol market experiences a downturn, the other products will keep the plant economically viable.

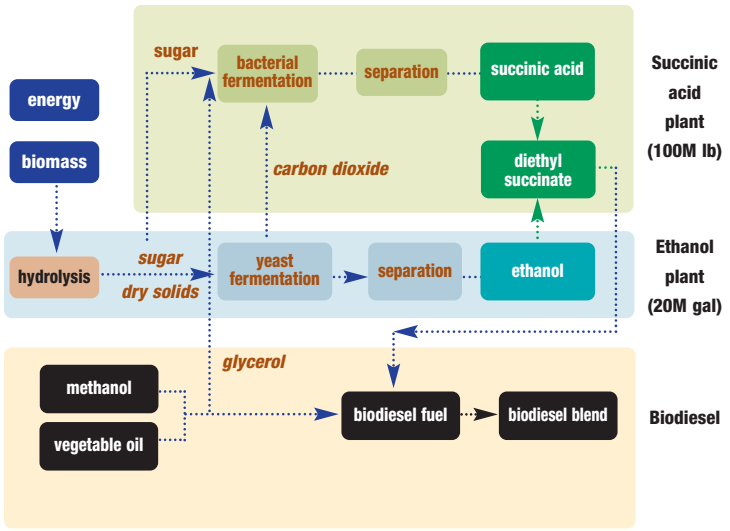
"We have to have a diversification strategy for biorefineries," Berglund said. "Fuels often have the lowest profit margins, so integrating fuels and chemicals in the same production facility makes good business sense.

"Sweden is really pushing the envelope on converting to bio-based products," he continued. "Three years ago, there were 10 E85 [a blend of 85 percent ethanol and 15 percent gasoline] stations in the country. Today there are more than 500. Sweden passed a law that said there had to be at least one alternative fuel pump at every station. There's also a lower tax on biofuels, so they're about 25 percent cheaper than gasoline. I think Michigan can learn a lot from what Sweden is doing."

::: Jamie DePolo



THE BIOREFINERY



Top photo: **MAES scientist Kris Berglund (left) and Dianne Holman are the co-founders of Working Bugs, a company that identifies microbes that could be used in fermentation processes to make products from renewable resources, as well as intermediate chemicals that are then used to make other bio-based products.**

Graphic above: **Berglund envisions biorefineries as processing plants that can produce a full complement of bio-based chemicals, fuels and other products. This creates a diversified operation that isn't subject to the ups and downs of a single market. If the ethanol market experiences a downturn, the other products will keep the plant economically viable.**

A Soil Ambassador

Alvin Smucker works with scientists around the world toward a common goal: improving biomass production and carbon sequestration by soils.

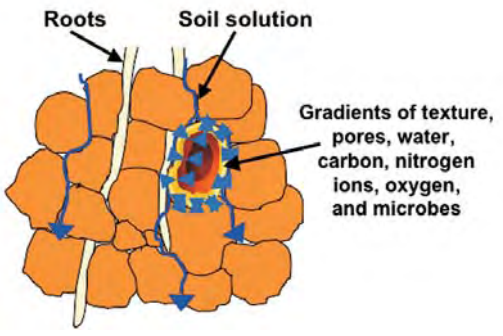
"Scientists often are the first-line ambassadors between countries," said Alvin Smucker, MAES soil biophysics scientist. "Even if political, ethnic and religious approaches to life are different and leaders have disagreements, scientists initiate globalization by exchanging research goals and expanding knowledge. Our graduate students and research associates contribute by traveling between countries. This enables scientists to foster a global community."

Smucker's 35-plus-year career is an on-going example of the benefits of global research collaborations. As soon as he received his doctorate in soil physics and plant physiology from MSU in 1971, he joined a team of scientists from six universities to build the Graduate School of Agricultural Sciences in Buenos Aires. Since then, he's worked with researchers in Australia, Poland, Hungary, Germany, Scotland, Sweden, Nigeria, Kenya, India, Brazil, Peru, South Africa, Egypt, Britain, Taiwan, Turkey, Finland, Austria, Switzerland, The Netherlands, Canada, Mexico, France and Italy; received the Alexander von Humboldt Research Award from the German government; been named a fellow by four scientific societies, including the American Association for the Advancement of Science; and was honored with a Distinguished Faculty Award from MSU.

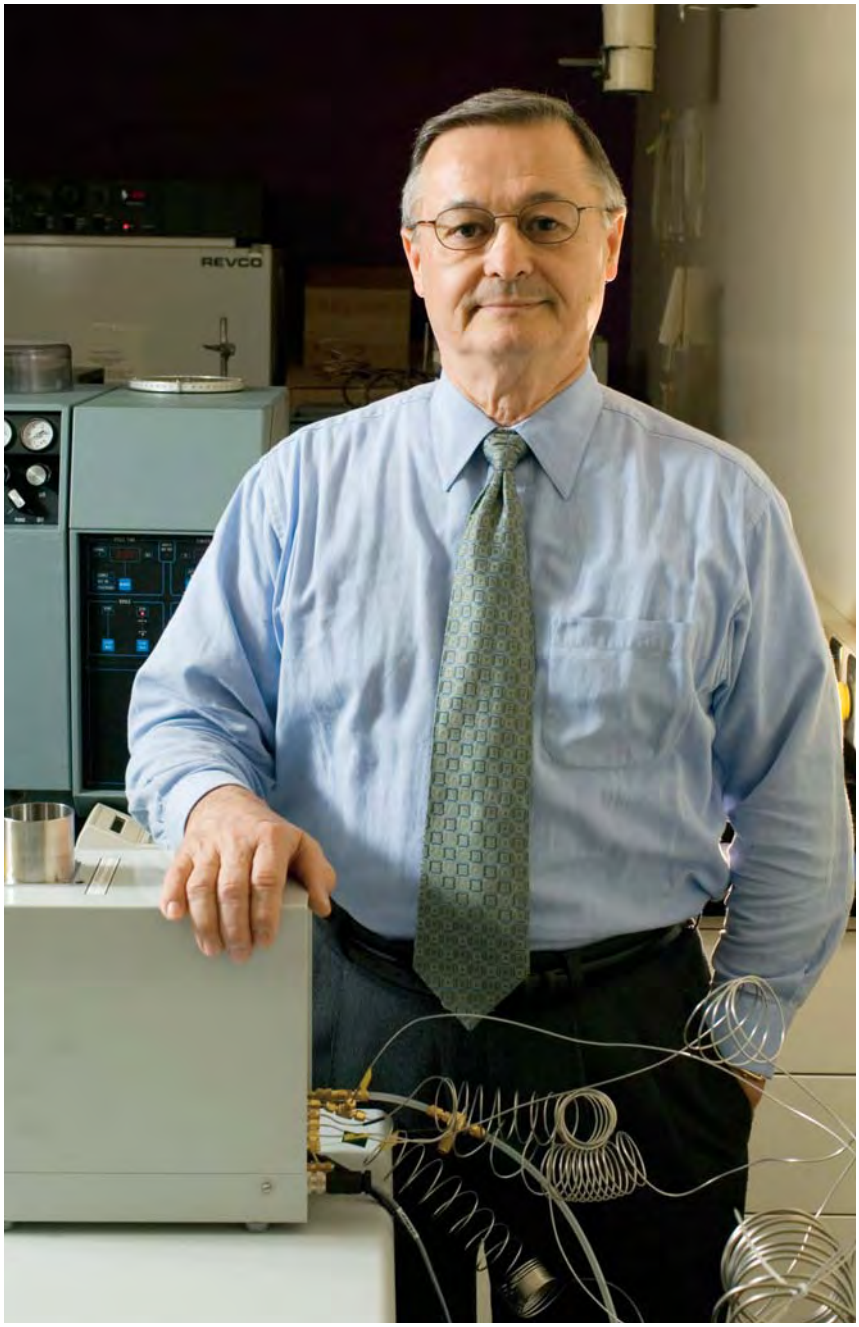
For Smucker, the reasons for international collaborations are myriad.

"The Michigan Agricultural Experiment Station and the Institute of International Agriculture have promoted the importance of international research exchanges," he said. "Deans, directors, department chairs and colleagues have been very supportive of collaborative global research. The knowledge base in any discipline is broader than just Michigan or just the United States. Working with scientists from other countries keeps science current. It unites researchers for a common cause and allows everyone to share their advances, as well as what didn't work. MSU research is in demand in other countries, but we also have much to learn. For example, Europe is nearly a decade ahead of the United States in the bookkeeping of carbon sequestration in soil. We needed to learn better carbon accounting and European scientists had that expertise. We didn't have to reinvent anything — we learned from what had been accomplished by scientists in other countries."

Liquid Flow through Pores Surrounding Soil Aggregrates



Carbon sequestration — capturing and holding carbon in soil — is an important component in reducing the negative effects of greenhouse gases (carbon dioxide, methane and nitrous oxide) in the atmosphere. At appropriate levels, greenhouse gases absorb heat and help maintain the world's climate. Without these gases the planet



One of MAES soil biophysics researcher Alvin Smucker's current projects is investigating the pores in and around soil aggregates, the basic structural units of soil. Using a synchrotron, he can view the interior of pores as small as 3 microns in diameter.

would be a frozen tundra. But if their concentrations become too high, research has shown that the gases may cause a dramatic increase in temperature. Plants take carbon dioxide out of the air and use it during photosynthesis. Over time, plants drop leaves, stalks and stems, which decompose and add carbon to the soil; the more carbon in the soil, the less carbon dioxide and methane released into the air. Keeping carbon in the soil is also hugely beneficial for soil productivity, sustainability and quality. The higher the carbon content in soil, the better the soil.

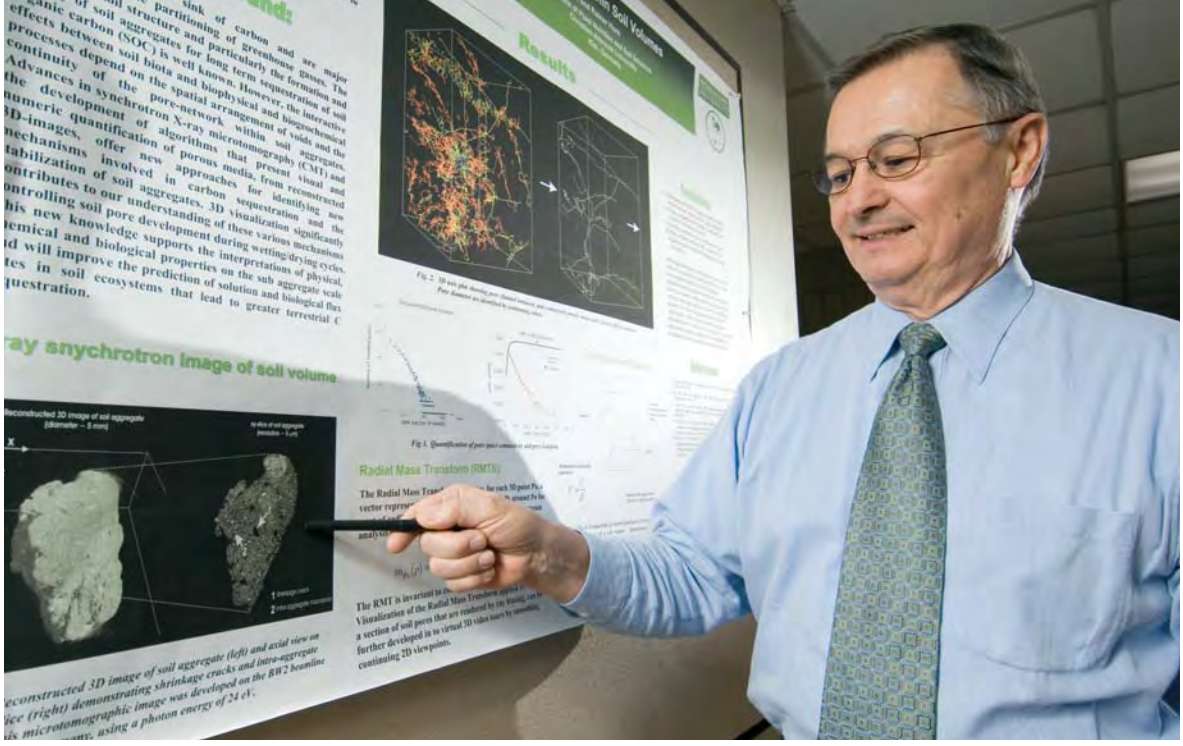
Carbon and Soil Structure

Much of Smucker's research focuses on soil aggregates, the basic structural units of soil. Aggregates are clumps of soil particles held together by moist minerals, positively charged mineral ions, organic matter such as plant roots, and organic compounds produced as microbes decompose plant parts. Hyphae, the threadlike filaments of fungi and bacteria, contribute to soil aggregate formation and function. Aggregates range in size from 0.002 millimeter (20 microns) to about 25 millimeters (1 inch). Soil aggregates are various sizes. Some fit closely together and some don't. The same is true for the soil particles within the aggregates — some fit closely together and some don't. The spaces between the aggregates are known as macropores. The spaces between the particles in the aggregates are called micropores. All these pores vary in size (macropores are generally larger than micropores) and are essential for storing air, water, microbes, nutrients and organic matter. Soil pores also control how solutions move through soils. Soils that have many stable aggregates are considered highly productive because they're less likely to erode.

Smucker studies the tiny micropores inside soil aggregates using a synchrotron, a billion-dollar piece of circular equipment that emits high energy x-rays. The x-rays display three-dimensional images of the interconnected pore pathways within an aggregate. Because the synchrotron equipment is so expensive, most individual universities can't afford to build one. Smucker cooperates with scientists and engineers at the Argonne National Laboratory in Illinois to use the synchrotron there.

"The synchrotron enables us to view pores as small as 3 microns in diameter," Smucker explained. "This is the first time we've been able to look at the interior porosity of soil aggregates. These images are giving us new information that will change some of the analysis that predicts flow through the soil matrix. We're collaborating with researchers around the United States and in Germany and Italy to develop new approaches to study how the connections among the pores modify the flow rates of bacteria, ions and water as they control carbon retention."

In mapping the interior of these tiny micropores, Smucker and his colleagues discovered that carbon can be stored in pores that are too small for bacteria to enter. Finding ways to get carbon into the micropores in soil aggregates would allow much more carbon to be sequestered in soil, stopping it from being released as carbon dioxide. This



By finding ways to get carbon into soil pores that are too small for bacteria to enter, Smucker hopes to double the amount of carbon that can be stored in soil by using conservation tillage techniques. Carbon sequestration — capturing and holding carbon in soil — is an important component in reducing the negative effects of greenhouse gases.

is desirable from both an agricultural and an environmental standpoint.

Soils can hold quite a bit of carbon. Plowing soil for agricultural or other use breaks up the soil aggregates and exposes the carbon in the soil to more microorganisms. The microbes then break down the carbon and release carbon dioxide. Aggregates that are broken also have fewer pores to store carbon. Research has shown that farmed soils initially had 40 to 50 percent more carbon in them than they do today. Production techniques such as using cover crops, which are planted and then cut down, allowing more organic matter (carbon) to work its way into the soil, and no-till and other conservation tillage practices that disturb the soil as little as possible mean more soil aggregates are left intact and more carbon is stored.

"Our goal is to double the amount of carbon stored in soil," Smucker said. "Agricultural production techniques are continually improving to increase carbon sequestration in the soil. Once the biogeochemical mechanisms of carbon storage are better understood, new management practices can be used to store about 50 percent more carbon over and above that achieved by conservation tillage alone."

Calcium carbonate is a very stable form of carbon that remains securely in soil aggregates. Smucker and his collaborators in the United States and Europe have identified biophysical and biogeochemical mechanisms in soil that enhance the development and retention of calcium carbonate in aggregate micropores. Over the next few years, Smucker plans to return to Europe to continue studying new carbon storage mechanisms.

Smucker is creating a Web-based soil aggregate pore image analyzer similar to the one he and MSU computer scientists developed to analyze plant root system geometries. The Root Image Processing Lab (http://rootimage.css.msu.edu/) runs MR-RIPL, software that analyzes video images of roots taken by minirhizotron cameras, miniature digital cameras inserted into the soil through clear plastic tubes. (Roots that have been washed by the hydropneumatic elutriation root washer, which was patented by MSU, also can be digitized by desktop scanners. These images then are processed by companion software, WR-RIPL.) Scientists from six continents use the online system. The results are used to analyze root growth and death rates and to compare carbon contributions to the soil by roots managed under various agricultural techniques.

The soil aggregate pore image analyzing software is being developed and refined in collaboration with scientists from Germany, Scotland, Italy and New York University.

"These analytical tools, available from Michigan State University, enhance both the sciences and MSU's global reputation," Smucker said. "Scientists around the world know they can depend upon sustained collaboration with MSU faculty members.

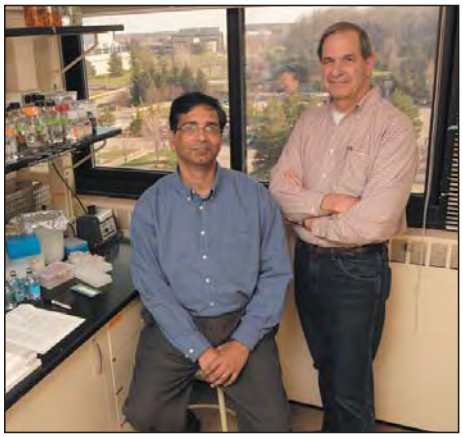
"My goal is to continue to expand collaborative science," Smucker continued. "I enjoy working with many excellent minds from as many disciplines and countries as possible. Everyone brings a different perspective and a different knowledge base to these projects, enriching the research. Because MSU's expertise is recognized around the world, other universities know the value of collaborating with us. I'm very grateful for the opportunities I've had to expand research and teaching at Michigan State and around the world."

::: Jamie DePolo

Research *in the news*

Scientists Developing Hand-held Pathogen Testing Device

Testing for deadly food, air and water pathogens may get a lot easier and cheaper, thanks to the work of a team of Michigan State University researchers.



Syed Hashsham, associate professor in the Department of Civil and Environmental Engineering and the Center for Microbial Ecology, is developing a portable, hand-held device capable of detecting up to 50 microbial threat agents in air, water and food.

"This device will give us the ability to measure pathogens in a manner and at a price that really matters for human health," Hashsham said. "If we can screen for all pathogens together, we can minimize the threat significantly."

Hashsham intends for the portable, hand-held device to be an all-in-one pathogen testing center where DNA amplification and pathogen identification will happen on the same DNA biochip. A DNA biochip has signature pieces of DNA attached to a silica surface, similar to that of a computer chip, and is about the size of a thumbnail.

Today, testing air, water or food for pathogens that cause diseases such as cholera and dysentery must be done one pathogen at a time. Testing for each pathogen singly is dangerous, expensive and time-consuming. Simultaneous testing simplifies the process, making it safer and more cost-effective.

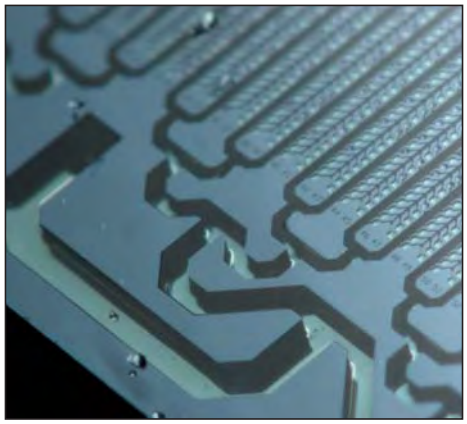
Earlier this year, Hashsham was awarded $966,608 from the 21st Century Jobs Fund to develop and commercialize the device.

Hashsham; James Tiedje, MAES crop and soil sciences researcher and director of the Center for Microbial Ecology; and Erdogan Gulari, professor of chemical engineering at the University of Michigan, formed a cross-disciplinary team to develop this technology.

To begin the testing, processing extracts DNA from all microorganisms present in the sample. The DNA is then introduced into the device, where it undergoes polymerase chain reaction (PCR) for the selected harmful pathogens. PCR is a process that takes a small amount of DNA and makes billions of copies so the pathogens can be easily detected, Hashsham explained.

Most of the genetic material in any bacterium isn't harmful. For instance, the bacterium *Vibrio cholerae*, responsible for the waterborne illness cholera, has many genes that maintain the organism but are not dangerous to humans by themselves. It's the gene producing the cholera toxin that is harmful. The harmless genes serve as good markers for detection. Hashsham's device will be designed to look for such marker genes.

"This technology is rugged and highly parallel; it can analyze lots of marker genes in a lot of samples, together with significantly lower false positives," Hashsham said.



He said the hand-held testing device could be used anywhere that cost-effective testing of food, water or air for a number of pathogens is needed.

"Because of the lower cost, there also will be applications in countries where fewer resources are available for drinking water safety," Hashsham said.

Looking toward the future, Hashsham has been in touch with several organizations that might be interested in the device. AquaBioChip, LLC, a Lansing-based company formed by the same team through a previous grant from the Michigan Economic Development Corp., will test the device under field conditions.

He has a team of six graduate students and technicians working on this device. "They are the heart of the project as well as the scientists being trained for the future," Hashsham said. "That number of employees is likely to increase when the device gets to the commercialization stage."

MSU Is Greener after Joining Chicago Climate Exchange

Michigan State University took another step toward being a "greener" place: MSU joined the Chicago Climate Exchange as another step in reducing greenhouse gas emissions.

CCX™ Chicago Climate Exchange

MSU President Lou Anna K. Simon, along with Fred Poston, vice president for finance and operations, and Michael Walsh, senior vice president of the Chicago Climate Exchange, signed the membership agreement during a ceremony at MSU's T.B. Simon Power Plant. The occasion was marked by a tree planting.

"Michigan State has tremendous power to educate and inform, to help motivate positive changes in behaviors, and to translate research by our students and faculty into practical solutions," Simon said. "This promises to be a powerful partnership in the best tradition of our world-grant mission that will result in innovations to help solve a significant global problem and make a difference in Michigan."

MSU will bring its broad expertise in environmental sciences, its history of stewardship and tradition of student involvement into play with the Chicago Climate Exchange. The exchange, or CCX, is North America's only, and the world's first, greenhouse gas emission registry, reduction and trading system for greenhouse gases.

Research *in the news*

Greenhouse gases are released into the atmosphere from the burning of fossil fuels and wood, and from the decay of plant and animal material. Greenhouse gases also reenter the life cycle as trees use carbon dioxide to grow and as the oceans absorb it. Imbalances, such as too much carbon gas released into the air, contribute to global warming.

Ultimately, scientists theorize, greenhouse gas emissions and reabsorption of those gases must be equal. Because some polluters produce more emissions than are legally allowed, they can go to the exchange and, in effect, buy from other participants who fell short of their cap on emissions.

Members of the Chicago Climate Exchange seek to reduce direct emissions by conserving energy, for example, and to provide opportunities to offset emissions such as no-till farming, tree farming or other carbon credits. MSU will work toward the prescribed 6 percent reduction goal.

It's a goal that will rely heavily on undergraduate involvement, Poston said.

"We have 10,000 graduates each year. We want to send them off equipped to be environmentally responsible," Poston said. "MSU's strength is that the integration of students speeds the translation to behavioral change."

Across campus, MSU's broad-based research in agriculture, forestry, engineering and environmental sciences, combined with a strong record of student engagement, positions the university for a unique partnership.

Membership in the CCX also will position Michigan's bioeconomy base, helping to move farming toward solutions in renewable fuels, in nontraditional farming methods and crops, and in environmentally sound practices, said David Skole, MAES forestry researcher.

"Our research base will enable us to work alongside the problem to help find solutions," Skole said. "Other members will look to us for guidance academically, and we'll be able to offer technical and research-oriented resources."

Carbon credits, Skole said, show promise as part of the future of farming. Carbon emission credits could become a commodity, much like crops and livestock.

MSU is the fifth university to join the CCX. The others are Tufts, the University of Iowa, the University of Minnesota and the University of Oklahoma.

Beede Named Outstanding Extension Specialist

David Beede, holder of the C.E. Meadows endowed chair and professor of dairy nutrition and environmental management, was named the 2006 Outstanding Extension Specialist by the Michigan Association of Extension Agents (MAEA) at the Michigan State University Extension (MSUE) Fall Conference in October. Beede is also a Michigan Agricultural Experiment Station scientist.

Each year an MSUE specialist working in a major commodity area is recognized for extraordinary and long-lasting leadership and service to MSUE and the people of Michigan through programming and applied research.

Beede was recognized for his applied research in phosphorus nutrition of dairy cattle and nutrient management and leadership with the MSUE Dairy Team. During his 12 years at MSU, he has written and presented extensively on the nutritional and environmental benefits of balancing the phosphorus requirements of dairy cattle and environmental sustainability, and he launched the Michigan Dairy Review (MDR), a statewide publication for the dairy industry.

"I arrived at Michigan State from the University of Florida in the fall of 1994, which just happened to be the year the Michigan Animal Agriculture Initiative was launched, including the MSU Extension dairy team," Beede said. "I got on the train with everyone else when things were just picking up steam in dairy Extension programs."

Beede worked with MSU faculty members to begin publishing the MDR in February 1996 with competitive funding from the Animal Agriculture Initiative (AAI). The AAI is Michigan's animal agriculture research, teaching and Extension initiative at MSU. The MDR is a quarterly publication with more than 6,500 free subscribers interested in research, teaching and Extension highlights from MSU dairy experts.

"MDR is considered nationally and internationally to be among the preeminent publications of its kind," Beede said. "It allows us to speak directly to dairy farmers, and that's one of the most important parts of providing exceptional Extension services."

To subscribe to the Michigan Dairy Review, visit www.mdr.msu.edu.

MAES Researchers' Paper in Journal of Natural Products Among Most Cited

In 1999, several MAES scientists collaborated on a paper in the Journal of Natural Products examining the health benefits of certain compounds in tart cherries. Today, that paper is in the top 10 of the journal's most cited papers.

"Antioxidant and anti-inflammatory activities of anthocyanins and their aglycon, cyanidin, from tart cherries" by Haibo Wang, former horticulture doctoral student; Muralee Nair, MAES horticulture researcher; Gale Strasburg, chairperson of Food Science and Human Nutrition; Yu-Chen Chang, former horticultural doctoral student; Al Booren, MAES food science and human nutrition and animal science researcher; Ian Gray, vice president for research and graduate studies and former

MAES director; and David DeWitt, associate professor of biochemistry and molecular biology, has been cited 121 times, ranking it eighth all time in Journal of Natural Products papers.

"The Journal of Natural Products is a premier publication put out by the American Chemical Society," Nair said. "Our publication was on the anti-inflammatory and antioxidant activities of anthocyanins, which make cherries, berries and other fruits and vegetables red. We were the first to demonstrate the beneficial health benefits of anthocyanins based on their antioxidant and anti-inflammatory activities. This ranking is a great recognition of the impact of our research on improving health and quality of life using natural compounds."

Composite Products May Open New Markets for Ag and Offer New Construction Materials

An endless number of jokes could be made about a house made from manure-based products. But it's no laughing matter — MSU Extension (MSUE) and the Michigan Agricultural Experiment Station (MAES) are working together on an idea that may help farmers handle waste, provide them with a new source of income and offer new, environmentally friendly products to the construction industry.

MSUE educator Charles Gould has a vision for new lines of composite materials that use a combination of plastic and manure fibers, instead of the wood that makes up current fiberboard and other building supplies, to develop products for use in the construction of everything from playground equipment to homes.

It starts with cows. Lots of cows, actually. There are more than 40,000 dairy cattle in Allegan, Ottawa and Kent counties, where housing development has limited the land available for manure application.

Farmers looking for alternatives to land application can choose to compost manure. Composting reduces its volume, makes it a more stable fertilizer source and eliminates odor. Another option is to use an anaerobic digester, which breaks manure solids down into a sterile, organic fibrous material and captures methane gas that can be used to produce electricity for the farm or sold to utility companies.

Gould read an article about how Iowa State University's biological composites lab successfully combined the fibrous material from a digester with plastic to create composite materials. He immediately saw the possibilities for western Michigan and contacted the lab director to request a visit and more information.

"They were gracious enough to show me what they were doing, and I thought, 'We can do this at MSU,'" Gould said. "I went to Laurent Matuana, MAES forestry researcher, who happened to know the researchers at Iowa State, and we developed a project proposal together."

The two submitted the proposal to the Michigan Biomass Energy Program. They received a small community education grant to hire Alex Cook, an undergraduate student, to develop two prototype products: a digester fiber/plastic composite product that could be used as decking and a medium-density fiberboard. The two products were tested and compared to similar products made using wood fiber. The products made with fiber from a digester passed with flying colors, meeting or exceeding industry standards for properties such as strength, stiffness and internal bond.

The digester fiber/plastic decking product performed better in tests against similar decking products made with wood/plastic. When two composite types were compared, the digester fiber/plastic decking product had properties that were superior to those of the wood product, including a darker color, which potentially could be more resistant to UV rays.

During the production process, the fibers intertwine and increase the strength of resulting composites. This offers an advantage in areas such as load-bearing capacity or material strength.

"The properties of the medium-density fiberboard met or exceeded standard requirements," Matuana said. "We have shown that value-added products can be successfully manufactured from digester fibers. Everything being equal, the digester fibers are giving us much better properties than wood."

There are numerous possibilities for construction materials containing the digester fibers. Because the chemicals used in the production of pressure-treated wood have been shown to be harmful to human health, the U.S. Environmental Protection Agency has outlawed use of pressure-treated wood in playground equipment. Fiber/plastic "lumber" could take its place. Other uses might include products for siding, furniture or lake-front seawalls.

Gould has already approached managers at two western Michigan home improvement retail chains to ascertain their feelings about carrying digester fiber/plastic decking or medium-density fiberboard made with the fibrous material from a digester.

"They indicated a willingness to purchase the product even though it was made out of fiber once found in manure because they perceived the products to be green," he said. The most common question asked was about odor. Neither the fiber/plastic decking nor the medium-density fiberboard emits an odor.

So when will a contractor be showing up at the door to build a fiber/plastic backyard deck? As in most cases, the answers are tied to questions of time and money.

"We do not foresee any problems pounding holes or drilling into it at this point, but that's one thing that still needs to be tested," Gould said, "and we need to find more money to do that."

Matuana concurred.

"There's still a lot to be done. Properties related to nailability, screwability and humidity have not been investigated," he pointed out.

Gould and Matuana are planning to submit another funding proposal to the Michigan Biomass Energy Program and are looking to other funding sources, both through grants and the private

sector. They also need to begin work on marketing plans.

Though the field of new, environmentally friendly materials could have positive economic impacts on the construction, nursery and possibly even the forestry industries, Gould is still thinking about the possibilities for his primary audience — farms and rural communities.

"There is a limited land base for manure application. Keeping Michigan's livestock industry strong and viable means we have to find a home for the manure generated by these farms," he said. "Why not make products from manure that benefit society, add value to the farming operation and, at the same time, fit nicely into a sustainable manure management system? At the end of the day, it's really all about sustainability."

Kells Named Crop and Soil Sciences Chairperson

James Kells was named chairperson of the MSU Department of Crop and Soil Sciences, effective Jan. 1.

Kells had been acting department chair since April 2005. He replaced Doug Buhler, who chaired the department from August 2000 to March 2005 before being named associate director of the Michigan Agricultural Experiment Station and associate dean for research for the College of Agriculture and Natural Resources.

Kells has been a Department of Crop and Soil Sciences faculty member since 1982 and served as associate chair of the department from 2003 to 2005. In addition to teaching, he holds appointments as a Michigan Agricultural Experiment Station researcher and an MSU Extension specialist. He has held key leadership roles with both the Weed Science Society of America and the North Central Weed Science Society, and he has served on numerous professional review committees.

He honors include the Campus Personnel Award from Michigan Farm Bureau, the Specialist of the Year award from the Michigan Association of Extension Agents and the MSU Outstanding Extension Specialist Award.

"Jim Kells' service as acting chair of the Department of Crop and Soil Sciences has been marked by excellence," said Jeffrey D. Armstrong, dean of the MSU College of Agriculture and Natural Resources. "He enjoys great respect among both colleagues and stakeholders for his superior service throughout his years on the faculty. I am confident that, through his leadership and vision, the department will continue at the national forefront in engagement, discovery and learning that are relevant to the needs of our constituents."

Kells holds both a bachelor's degree in crop and soil sciences and a doctorate in weed science from Michigan State University. He received a master's degree in weed science from the University of Kentucky.

Norris Named First Guyer/Seevers Chair

Patricia Norris, MAES natural resource economist, has been named the first holder of the Gordon and Norma Guyer and Gary L. Seevers Chair in Natural Resource Conservation at MSU, following a national search.

The Guyer/Seevers chair was created to address critical issues in the use and conservation of Michigan's natural resources, with an emphasis on stakeholder involvement and teaching students to take leadership roles in natural resource fields. Its goal is to have a positive and sustained effect on Michigan's natural resources through those who are managing them today and those who will do so in the future.

Norris, an MSU faculty member since 1996, has an extensive background in issues affecting land and water resources and has conducted research addressing issues in soil conservation, water quality, groundwater management, wetland policy, land markets, land use conflicts and farmland preservation. She co-chairs the MSU Extension Land Use Team, which conducts educational and training programs in land use policy and resource management.

The Gordon and Norma Guyer and Gary L. Seevers Chair in Natural Resource Conservation will focus on finding comprehensive solutions to natural resources issues in a three-tiered effort: cultivating student leadership for natural resource fields, conducting research focused on natural resource use, and serving as a resource to industry, government and non-profit organizations involved in making decisions affecting natural resources.

"I am tremendously pleased that Pat Norris will be our first Guyer/Seevers chair," said Scott Witter, chairperson of the Department of Community, Agriculture, Recreation and Resource Studies (CARRS). (The Guyer/Seevers chair is housed in CARRS.) "Her work in market-based policy approaches to natural resource issues and her strong outreach background are a natural fit for the vision of this position."

"Pat Norris' skills and expertise will shape the Guyer/Seevers chair as a national model for stakeholder-driven approaches to natural resource conservation," said Jeffrey Armstrong, dean of the College of Agriculture and Natural Resources (CANR). "I am extremely grateful to Dr. Gordon Guyer and Dr. Gary Seevers for their vision and leadership in

establishing this endowed chair, which will allow us to engage in more coordinated and comprehensive planning of the uses to which Michigan's natural resources are put."

Before coming to MSU in 1996, Norris was associate professor of agricultural economics at Oklahoma State University. A native of Georgia, she received her undergraduate degree in agricultural economics from the University of Georgia and her master's and doctoral degrees in agricultural economics from Virginia Tech. She received the Outstanding Extension Program Award from the MSU Department of Agricultural Economics in 2005 and the Outstanding Extension Specialist Award from the MSU Extension Specialists Association in 2004. She is past president of the MSU Extension Specialists Association and a member of the American Agricultural Economics Association, the Southern Agricultural Economics Association and numerous professional honor societies. She has served as a peer reviewer for nearly two dozen professional journals and was a member of the editorial council for the Journal of Agricultural and Applied Economics for five years.

Gordon Guyer and Gary Seevers are both triple-degree alumni of the CANR: Guyer received bachelor's, master's and doctoral degrees in entomology; Seevers received a bachelor's degree in animal science and a master's degree and doctorate in agricultural economics. Guyer, who served as the 18th president of MSU, served the university in many capacities, including vice president for governmental affairs, director of the W.K. Kellogg Biological Station, associate dean of the colleges of Natural Science and Agriculture and Natural Resources, director of MSU Extension, director of the Pesticide Research Center, and professor and chairperson of the Department of Entomology. He continues his service to MSU with many professional and volunteer projects and programs. Seevers, of Westport, Conn., is an accomplished economist and financial market specialist who served a distinguished career in Washington and on Wall Street before retiring as a limited partner with Goldman Sachs.

Rothwell Named Northwest Michigan Horticultural Research Station Coordinator

Nikki Rothwell was named coordinator for the Northwest Michigan Horticultural Research Station and district Extension horticulture educator, effective Jan. 1, 2007.

Rothwell oversees day-to-day operations at the Northwest Michigan Horticultural Research Station and associated efforts. Rothwell works with fruit industry representatives to determine research priorities, interact with regional and MSU-based faculty members to coordinate research activities, and conduct industry workshops and field days for growers.

Rothwell also provides leadership and coordination for MSU Extension horticultural educational programs and activities in northwestern lower Michigan and disseminates current research-based technical and management information to the fruit industry.

"I am very excited to have someone of Nikki's caliber serving in this important role," said Patrick Cudney, MSU Extension regional director for northern lower Michigan. "She has a tremendous zeal and passion for the fruit industry and brings her extensive energy, research and Extension backgrounds to the position."

Rothwell was previously the MSU Extension district fruit IPM (integrated pest management) educator. She was responsible for developing programs and disseminating IPM information and conducting related research for the northwestern lower Michigan fruit industry.

"The work carried out at the Northwest Michigan Horticultural Research Station is a critically important component of our efforts to help maintain the viability of Michigan's fruit industry," said Doug Buhler, Michigan Agricultural Experiment Station associate director. "Nikki's work will allow us to continue to build upon a very solid foundation of research and extension to the benefit of growers, suppliers, processors and consumers."

Rothwell received her bachelor's degree in biology from Western Michigan University, her master's degree from MSU and her doctorate from the University of Massachusetts-Amherst. She held adjunct faculty teaching positions at the University of Massachusetts and Springfield Technical Community College before coming to Michigan.

Vargas Honored by Golf Industry

Joe Vargas Jr., MAES turfgrass scientist for 38 years, received the 2007 Green Section Award from the U.S. Golf Association (USGA) Feb. 23 at the USGA Green Section Education Conference in Anaheim, Calif. The annual award recognizes contributions to golf from turfgrass research.

"It was a great surprise when I was told I was going to receive this award," Vargas said. "I was shocked. I have gotten a lot of awards, but this one is very special."

"Few have contributed more to turfgrass management than Joe Vargas within the past four decades," said a USGA representative. "Dr. Vargas has been challenging normal turfgrass management practices from the start."

"I always have spoken my mind," Vargas said. "But everything I've ever introduced has been based on solid research."

Research *in the news*

In the 1970s, Vargas discovered that, contrary to popular opinion at the time, annual bluegrass does not routinely die from high temperatures in the summer but from two diseases common to the grass. Vargas identified the problem and suggested new management techniques. Today, annual bluegrass is the principal turfgrass species on many golf courses.

Vargas also was the first to recognize that a bacterium caused the decline of a specific strain of creeping bentgrass. This research and other work that followed helped turfgrass managers realize that bacteria can affect turfgrasses. It also helped lead to the introduction of new creeping bentgrass varieties.

Karl Danneberger, turfgrass researcher at Ohio State University, called Vargas one of the five most widely known turfgrass scientists in the world.

"He is at the forefront of turfgrass diagnosis," Danneberger said. "I do not know of anyone who is better in identifying a golf course superintendent's problem on site."

Vargas has published more than 300 articles on turfgrass diseases and related subjects. His books are widely used in the industry, especially *Management of Turfgrass Diseases*, which is on almost all golf course superintendents' shelves. His current research is aimed at developing healthy grasses that require fewer pesticides, need less sunlight and are more disease-resistant.

A native of Fall River, Mass., Vargas worked on the maintenance staff at the Fall River Country Club as a teenager. He received his bachelor's degree from the University of Rhode Island, his master's degree from Oklahoma State and his doctorate from the University of Minnesota. He came to MSU in 1968.

Vargas has delivered more than 1,000 presentations at various turfgrass conferences throughout the world, including talks in Australia, Argentina, China, New Zealand, Japan and South Africa, some of the hot spots in golf's new frontier.

"My career has been a love affair since I was 14 years old," Vargas said. "Why would I ever retire? This is what I enjoy doing. And there is so much more to do. We have to find better ways of managing grasses."

New Faculty Members

The MAES is pleased to welcome two new faculty members with MAES appointments.

Zhengfei Guan, an expert in econometric analysis, was named assistant professor of agricultural economics in January. His research interests include measuring the performance of agribusinesses, the economics of sustainable agriculture and production modeling, as well as agricultural and environmental issues in China.

From 2004 to 2006, Guan held various university positions, including visiting scholar in the Department of Economics at the State University of New York at Binghamton and postdoctoral researcher at Wageningen University in the Netherlands. While at Wageningen University, he worked on a European dairy industry model. From 1992 to 1999, Guan monitored and evaluated World Bank projects and conducted financial planning and analysis for the Department of Finance and Planning of the Jiangsu Agribusiness Group.

Guan received his doctorate in business economics and his master's degree in agricultural economics and management, from Wageningen University in 2005 and 2001, respectively. His dissertation focused on arable farming, and his thesis focused on horticultural firms. He received his bachelor's degree in international economics and trade from Nanjing University in 1992.

Julia Busik, assistant professor of physiology, received an MAES appointment Jan. 1. Damage to the blood vessels in the eye as a complication of diabetes is a leading cause of blindness in adults. Busik's research seeks to identify the risk factors and design prevention strategies for this disorder. In particular, her work focuses on the role of dyslipidemia in the onset and progression of diabetic retinopathy and explores the potential of dietary fatty acids to prevent retinopathy.

Busik came to MSU as a visiting research associate in 1996 and was named assistant professor for research in 2001. She received a tenure-track position in January 2007. Before her MSU appointment, she was a graduate assistant at the Laboratory of Cellular Metabolism at the National Institute for Physiological Sciences in Okazaki, Japan, and a junior research associate at the Institute for Physiology at the Siberian Branch of the Academy of Medical Sciences in Novosibirsk, Russia.

A member of the Association for Research in Vision and Ophthalmology, Busik serves as an ad hoc reviewer for the American Journal of Physiology, Investigative Ophthalmology and Visual Sciences, Diabetes/Metabolism Research & Reviews, and Diabetes. Since 2006, she has been a member of the American Diabetes Association Research Grant Review Committee. She received her doctorate in physiology from the Graduate University for Advanced Studies in Yokohama, Japan, in 1995, and both her master's degree in physiological genetics and her bachelor's degree in the natural sciences from Novosibirsk State University, in the USSR, in 1991 and 1988, respectively.

Ferris Honored by Purdue

John N. "Jake" Ferris, professor emeritus of agricultural economics and longtime MAES faculty member, received the Certificate of Distinction from the Purdue Agricultural Alumni Association at the group's annual meeting on Feb. 3. The certificate is the group's highest award.

A prolific author, outstanding teacher and researcher, and highly regarded MSU Extension specialist, Ferris' research focuses on agricultural marketing, outlook and economic development (domestic and international). Though retired, he continues to maintain AGMOD, an econometric/simulation model of U.S. agriculture with a satellite model on Michigan he developed. AGMOD generates year-to-year forecasts for a 10-year timeframe. In 1997, McGraw-Hill published his textbook, *Agricultural Prices and Commodity Market Analysis.* After a favorable review in the May 2004 issue of the American Journal of Agricultural Economics, a new edition has been published by the MSU Press. Ferris also is a five-time recipient of the Premier Forecaster Award from the American Agricultural Economics Association.

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