Growing South Dakota

A MAGAZINE BY SOUTH DAKOTA STATE UNIVERSITY
COLLEGE OF AGRICULTURE & BIOLOGICAL SCIENCES / SPRING 2017

Collaborating On Oats

Fetal Programming Focus

Diagnosing Plant & Animal Diseases

South Dakota Agricultural Experiment Station

Research at SDSU

2016 Annual Report

FROM THE DEAN

Today's Research Is Tomorrow's Prosperity

The South Dakota Agricultural Experiment Station (SDAES) provides the major research activity for SDSU's Agriculture and Biological Sciences College, and within this issue of Growing South Dakota we are proud to highlight the SDAES 2016 Annual Report.

We never know what new challenges or unique problems will confront us in the future. Thus, the best way to be prepared is to make certain we maintain the capacity to conduct unbiased research necessary to solve new problems. That is what the SDAES does for South Dakota: builds and maintains the infrastructure and the personnel to solve today's problems with scientific research so that we are ready to tackle tomorrow's problems with the same high quality, credible, unbiased scientific research.

Previous articles in Growing South Dakota have highlighted SDSU's newly inaugurated teaching facilities for beef cattle and swine production. These facilities will also have big impacts on research outputs. In this annual report, we feature articles highlighting a variety of our other lines of research. All of this research will ultimately contribute to our well-being in South Dakota and beyond.

It is exciting to have a front row seat to see our talented faculty, staff and students putting their creative problem-solving skills to work to make things better for our broad community. Their research is leading to crops that are higher yielding, higher quality and more disease resistant, to better understanding of crop and livestock diseases, and to solutions to prevent obesity, to name a few of areas of impact. That said, we must also keep top-of-mind preparing for future challenges.

The public land-grant university system got its start with a concern for the future. To flourish, the United States needed an increasingly educated and engaged population. It also needed an ability to feed itself — an ability that would grow with its population growth. Leaders recognized that the agricultural land-base could not be expanded indefinitely, so education and research was needed to be able to sustainably meet future needs with a finite resource.

Establishing the land-grant university system through the Morrill Act of 1862 was the first step. The second step was the Hatch Act of 1887, which gave birth to Agricultural Experiment Stations in the states. The SDAES, a product of the Hatch Act of 1887, forms a large part of the research program of the ABS College research program. The insight leading to the Hatch Act was a huge step in making good on the vision of the Morrill Act to first discover the new knowledge that was needed and then to teach it: knowledge about how to feed the growing and expanding US population without depleting the natural resources that makes food production and societal well-being possible.

Experiment stations today, SDAES included, have a more complex scope. As always the SDAES is responsible for discovering and testing solutions to those problems that challenge profitable and sustainable production agriculture. But it also includes human nutrition and health, animal health, and the interfaces between animal health, human health and food safety.

The South Dakota Animal Disease Research and Diagnostic Laboratory (ADRDL) is a fundamental service of the College and the State of South Dakota. The ADRDL's responsibilities as given in state law are for both the diagnosis of animal disease and the research to help speed up diagnosis and protection against diseases. The "research" responsibility is the "R" in ADRDL.

Research is a team effort that requires a physical infrastructure and a support team. It was brilliant for state decision-makers to place responsibility for operating the ADRDL within the university. By operating together, the two function as strong partners to serve the state's interests. Disease outbreak events over the last few years convincingly show us that we can expect new animal disease challenges: pneumonia in bighorn sheep, avian influenza, epidemic porcine diarrhea, to a name a few. We cannot predict what will be the next major disease challenge, when it will occur and what animal populations it will impact. Preparedness is the best pathway to protection.

That is why it is so important that our ADRDL be prepared to meet demands. Now is the time to expand the capacity of the ADRDL for the volume of testing that is expected over the coming years and to elevate the biosafety level to meet today's standards for worker and industry safety. Our economy in South Dakota and our well-being as South Dakotans is intertwined with our animals.

Today's research is tomorrow's prosperity. Many of the technologies and much of the know-how we benefit from today in agriculture, in biology, in natural resources, and in rural communities comes as a result of prior research. The research we did in 2016, and the research we will do during 2017 and the ensuing years, will yield benefits to our state and our communities over years to come. Our faculty in the ABS College are keenly aware of that important, far-reaching purpose as they strive to harness the research infrastructure at SDSU and SDAES to solve today's problems and be ready to solve tomorrow's.

DANIEL SCHOLL, PH.D – INTERIM DEAN

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Interim Dean, College of Agriculture & Biological Sciences and Director, SD Agricultural Experiment Station: Daniel Scholl

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Interim Director of SDSU Extension: Karla Trautman

College of Agriculture & Biological Sciences Director of Marketing & Communications: Lora Berg

Editor: Kindra Gordon

Contributing Writers: Christie Delfanian, Joe Roybal, Lora Berg, Sydney Sleep

Designer: Kristi Schelhaas

Project Coordinator: Wendy Thorstenson

Photography provided by Emily Weber and Ruth Beck

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Please notify the College of Agriculture & Biological Sciences if your address has changed.

College of Agriculture & Biological Sciences,
South Dakota State University
131 Berg Agricultural Hall (SAG),
Box 2207,
Brookings, SD 57007
Phone: 605-688-4148
Fax: 605-688-6320
Email: SDSU.agbio@sdstate.edu

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FROM THE ASSOCIATE DIRECTOR

Multi-Disciplinary Research: A Strength & Tradition Of SDSU

In May, Dean of the College of Agriculture and Biological Sciences (ABS) Barry Dunn, was selected as the 20th President of SDSU. In this transition, Daniel Scholl has agreed to serve as Interim Dean of the ABS College, while continuing as Director of the South Dakota Agricultural Experiment Station (SDAES). I've been asked to serve as Interim Associate Director of SDAES.

I'm far from a new face at SDSU, having joined the Biology & Microbiology Department as an assistant professor in 1987. Over these past 29 years, I've collaborated with a broad range of faculty from several departments on multi-disciplinary efforts focused on production of value-added products from agricultural feedstocks and residues. Thus, I have a deep appreciation for the diverse knowledge and skills of our college's faculty, and their abilities to make basic science discoveries and transform them via applied research into solutions that benefit our citizens, the nation, and even the world.

Even as an undergraduate, and subsequently a graduate student at SDSU, I was able to participate in one of the most impactful projects ever conducted at SDSU. This was the groundbreaking ethanol fuel research and development project that began in 1977.

Since that humble beginning, the ethanol technology initially developed at SDSU has grown and spread across the country. This growth was led by South Dakota's agricultural community, who embraced the vision of value-added agriculture and invested their time and financial resources to commercialize this technology. With over 200 operating facilities, this industry now converts about one third of our nation's annual corn crop into 15 billion gallons of ethanol and 45 million tons of high protein distillers' grains. This is enough ethanol to satisfy over 10% of our annual gasoline needs and enough distillers' grains to feed over 50 million cattle. Nationwide this industry provides 86,000 direct jobs as well as over 270,000 indirect and induced jobs, and in 2012 had a $3.8 billion overall impact on South Dakota's economy.

The SDSU fuel ethanol project initially involved researchers from the departments of Agronomy, Horticulture, and Plant Science; Agriculture and Biosystems Engineering; Mechanical Engineering; Biology & Microbiology; Dairy & Food Science; Animal Science; and Economics. Subsequently, researchers from the Natural Resource Management; Chemistry and Biochemistry; and Sociology and Rural Studies Departments joined the project as the emphasis shifted to production of renewable fuels and chemicals from unutilized biomass residues. Much of this work has been conducted with university and industrial collaborators located across the nation, and several technologies thereby developed are currently being commercialized.

A good share of the financial support for this work was provided through the Sun Grant Initiative, which was developed through the vision and leadership of Kevin Kephart, Vice President for Research and Economic Development. He recently stepped down from his position after a distinguished, 30-year career at SDSU.

During our years at SDSU, both Dr. Kephart and I have recognized that a multidisciplinary, systems-based approach to research is the most effective, efficient, and comprehensive way to study complex systems. This approach takes into consideration multiple perspectives to determine the full costs and benefits of technologies to provide accurate, relevant, and impactful answers for stakeholders.

Today, multidisciplinary research increasingly involves social scientists to explore the public's understanding of research innovations, so that societal concerns can be addressed as a part of technology development. This also means the ties between research and extension are more important than ever, as we rely on SDSU Extension to extend our research to stakeholders who will implement the technologies, as well as the public to ensure their understanding and acceptance. We also rely on SDSU Extension to gather the input we need to guide our research so that it fulfills the needs of the people we are charged to serve.

This issue of Growing South Dakota highlights multidisciplinary projects being conducted at SDSU. In future issues we will share others. As always, we enjoy hearing your comments at sdsu.agexperimentstation@sdstate.edu.

Bill Gibbons

FIGURE 1: SDAES External Research Funds (Grants, Cooperative Agreements, and Contracts) – Fiscal Year 2016

Actual Expenditures:
Total $13,411,155

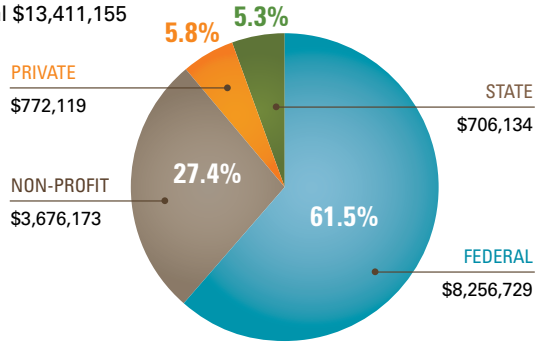
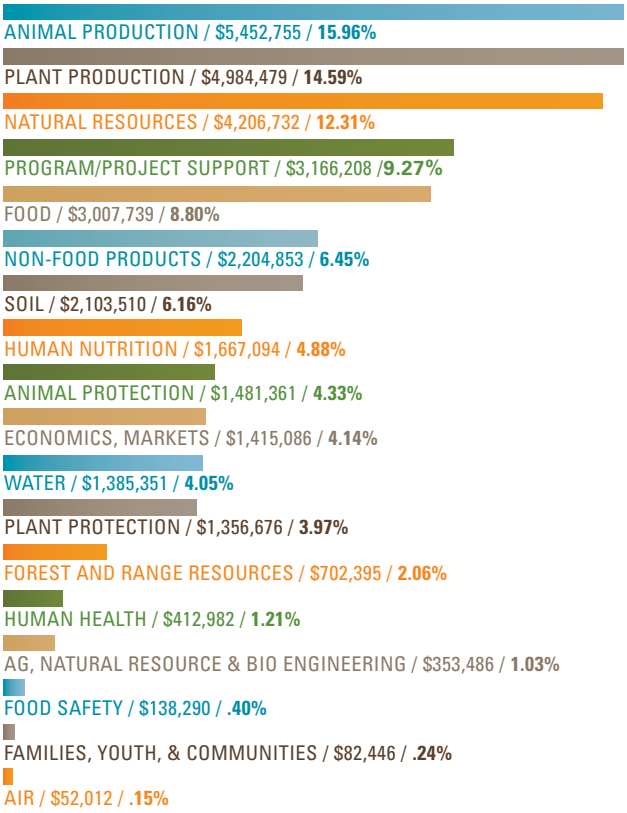


TABLE 1: Distribution of all SDAES Expenditures – Fiscal Year 2015

Actual Expenditures: Total $34,173,455



Opportunities With OATS

SDSU Researchers Strive To Improve Varieties

SOUTH DAKOTA STATE UNIVERSITY scientists are conducting research to increase the quality of South Dakota-grown oats. Oat breeder Melanie Caffe-Treml and her collaborators are developing ways to improve the nutritional and milling quality of new oat varieties.

Caffe-Treml and her colleagues were recently awarded a two-year, $150,000 grant from the USDA to support their research efforts. She works closely with Associate Professors Jixiang Wu and Jose Gonzales of the Agronomy, Horticulture, and Plant Science Department as well as cereals chemist Professor Padu Krishnan from the Dairy & Food Science Department.

The researchers are developing methods to speed up selection of breeding material. "We are developing genomic selection models," Caffe-Treml explains. Through collaboration with research geneticist Shiaoman Chao of the USDA Agricultural Research Service in Fargo, ND, Jean-Luc Jannink at the USDA-ARS in Ithaca, NY, and Canadian scientists, the researchers are developing models to predict milling and nutritional quality based on genetic markers.

During the two-year project, the researchers will genotype and test 450 lines of oats at four locations—Volga, Winner, South Shore and Beresford, SD. Based on the genotype, or DNA

makeup of the plants, a model will be created to predict the phenotype (visible characteristics) for untested breeding lines, the way which those traits will be expressed within the plant. Nick Hall, technician, Sudha Adhikari, graduate student, and several undergraduates are participating on this project.

In terms of nutritional quality, the team is also developing a near infrared reflectance spectrometry calibration to determine the beta-glucan content of individual seeds. This work is done in collaboration with a USDA lab in Kansas. Beta-glucan is the soluble fiber in oats that helps decrease blood cholesterol levels.

"By sorting those seeds with higher beta-glucan content, we can remove those least likely to perform well at an earlier stage," Caffe-Treml explains. "That allows us to focus more on evaluating those with the highest chance of performing well — that's more efficient."

Comparing the performance of the higher beta-glucan lines with those that have not been sorted will indicate whether this selection process will help increase the nutritional value of oat varieties.

SDSU's oat breeding research program dates back to 1887 when the South Dakota Agricultural Experiment Station was founded. According to South Dakota Agricultural Experiment Station records, the first SDSU oat variety, "Cole," was released in 1909. As of 2016, a total of 30 new oat varieties have been released by SDSU.

The current SDSU oat breeding program focuses on increasing productivity and marketability for producers across the Midwest. SDSU oat breeders are conducting trials all across South Dakota to confirm varieties can withstand the state's varied growing environments.

By Christie Delfanian and Lora Berg

Food Perspective

Food science professor Padu Krishnan (left) and graduate student Devendra Paudel discuss results of scanning ground or whole oats for protein, fat and beta glucan content, as part of research to assess the quality of oats. This will help breeders improve oat varieties for use in food products. Krishnan and his research team have developed robust near infrared calibrations based on grain samples from South Dakota, Washington, Iowa and North Dakota. The project, in its second year, is funded by a three-year, $140,000 grant from General Mills and Grain Millers, Inc.

Partnership Produces

Oats Research Lab

DURING THE SUMMER OF 2016, General Mills and SDSU held a ribbon cutting ceremony to announce the opening of a state-of-the-art oat variety development lab. The Oats Research Laboratory is focusing on advancing the sustainability and quality of oats in the US.

The new collaborative oat research laboratory, housed in the Young Brothers Seed Technology Building near the SDSU campus, includes labs, greenhouses and access to field trials. General Mills agronomists and plant breeders are working alongside SDSU's Agronomy, Horticulture and Plant Science Department comprised of plant breeders, grain scientists, seed experts, environmental scientists, field station managers and student researchers. Together, their efforts focus on improving the nutritional qualities of oats; developing better performing oat varieties with higher yields; and helping farmers improve agronomic practices to increase sustainability.

"At South Dakota State University, we believe strongly in public/private partnerships and the synergies they bring to research and innovation," said Barry H. Dunn, SDSU President, at the ribbon cutting ceremony. "This relationship combines an international innovator in consumer foods and the leading land-grant institution in the country's second largest oat-producing state. The new laboratory will be a powerful shared opportunity to enhance agricultural productivity and food production, and help stimulate sustainable economic growth and prosperity."

South Dakota is a natural fit for the lab because the state was ranked second in US oat production in 2015 and the public breeding program is one of the mainstays of the South Dakota Agricultural Experiment Station. Oats are a critical part of South Dakota's crop rotation, providing soil health benefits, reducing soil erosion, requiring fewer inputs and no irrigation water while producing a nutrient-rich product.

"We have a responsibility as a public-land grant university and agricultural experiment station to provide growers in our state and throughout the US oat varieties and production systems that optimize profitable production and meet the needs of their markets," says Daniel Scholl, Interim Dean of the College of Agriculture & Biological Sciences, and Director of the South Dakota Agricultural Experiment Station. "South Dakota growers prompted and helped the revitalization of oat variety development at SDSU and this scientific partnership with General Mills, a major buyer of South Dakota oats, brings value right back to the oat grower."

Oats are at the core of General Mills' business, with more than 600 products in the company's US portfolio containing oats. In fiscal 2015, 25 percent of the company's US retail sales volume comprised products containing whole grain oats. Since 1941, the company has brought the power of oats to consumers when Cheerioats were introduced—the first ready-to-eat cereal made from oats, now better known as Cheerios. As one of the largest buyers of North American oats, General Mills hopes that partnering with the top researchers and agronomy students at SDSU will enable the company to improve the quality and supply of oats, and increase the profitability of the crop.

"We're honored to be here working alongside some of the brightest agricultural researchers in the country," said Jim Kirkwood, vice president and chief science and technology development officer at General Mills, during the ceremony. "Our company has made a public commitment to source 100 percent of our oats by 2020 from growing regions that demonstrate continuous improvement against industry-based environmental metrics. Having a venerable institution like SDSU as a partner will allow us to do more innovative oat breeding research in the labs and fields—and get us to that goal."

By Lora Berg

Stopping Stem Canker

Plant Pathologist Making Progress In Identifying Fungicides And Genetics To Keep This Disease At Bay

WITH OVER 75% OF ALL SUNFLOWERS grown in South Dakota, North Dakota and Minnesota, sunflowers are an important crop to the region. So in 2010, when a Phomopsis stem canker epidemic impacted sunflowers, finding methods to minimize the disease became a top research priority to the National Sunflower Association.

One of the leading researchers in this effort is SDSU plant pathologist Febina Mathew. Mathew explains that two Phomopsis stem canker pathogens, *Diaporthe helianthi* and *Diaporthe gulyae*, cause lodging and reduced yields by as much as 40 to 50% in sunflower crops. Both pathogens have been found in South Dakota fields.

Presently, some sunflower hybrids are available that offer partial resistance to the disease, and strobilurin fungicides (QoI inhibitors) exist to help protect the crop from the disease. However, Mathew explains that once a crop becomes infected with Phomopsis stem canker little can be done to stop it.

With funding support from the National Sunflower Association, the South Dakota Oilseed Council, and the South Dakota Agricultural Experiment Station, Mathew's research related to Phomopsis stem canker includes two major studies. One study is evaluating application timing of fungicides for better disease control. A second study is screening sunflower genotypes to try to identify those with resistance to both pathogens.

In collaboration with researchers from North Dakota State University and the University of Nebraska-Scottsbluff, Mathew and her colleagues are evaluating the efficacy of fungicide applications to sunflowers at different growth stages to determine field response and control. Both test plots and farmer plots are included in the research.

Mathew reports this research will continue as they have not yet determined the optimal fungicide timing to provide complete disease protection through the growing season.

Additionally, Mathew says because Phomopsis stem canker is difficult to control with fungicides, she has initiated research to look at existing hybrids and determine if any resistance to the pathogens could be identified.

With Mathew's guidance, graduate student Taylor Olson began to screen 54 sunflower genotypes from nine different countries in Fall 2015. The genotypes were publicly available from the North Central Regional Plant Introduction Station at Ames, IA.

A diagnostic assay was developed to test the material and DNA was extracted from all 54 genotypes and subjected to the Phomopsis stem canker pathogens.

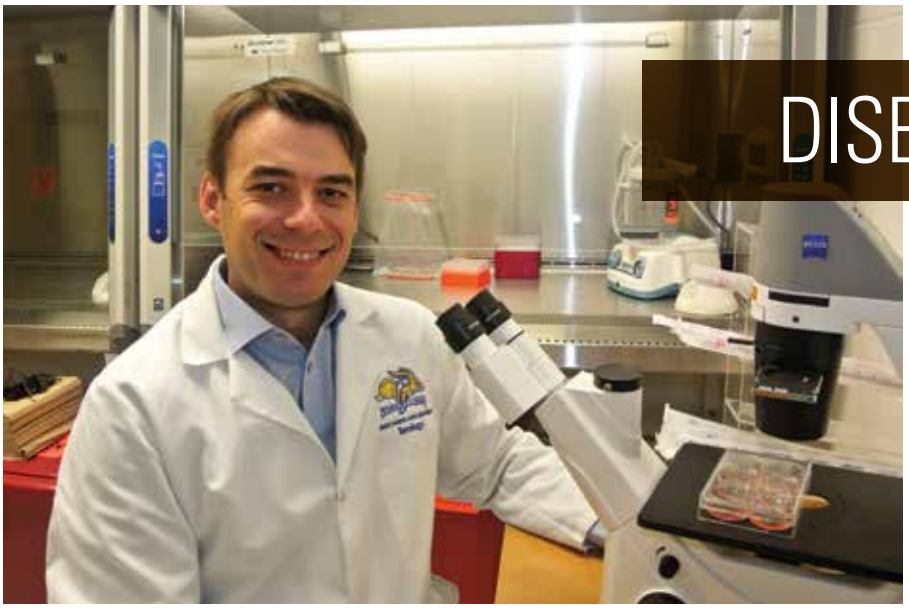
In November 2016, the research yielded exciting results: Olson identified one genotype that has resistance to *Diaporthe helianthi* and another that has resistance to *Diaporthe gulyae*.

Mathew says now that genotypes that have resistance to the two pathogens have been identified, the next steps will include collaborating with molecular biologists and plant breeders to eventually breed the resistant genes into a hybrid that also maintains sunflower yield and production qualities.

While that timeline could take a decade until a resistant hybrid to Phomopsis stem canker is commercially available, Mathew says this is a breakthrough. "We are excited we found genotypes with resistance to the Phomopsis stem canker pathogens. The discovery of these resistant materials will begin a new direction for future research into this disease," she concludes.

By Kindra Gordon

Pictured: Plant pathologist Febina Mathew (left) and graduate student Taylor Olson are researching methods to reduce the incidence of Phomopsis stem canker in sunflowers.



DISEASE DETECTIVES

Vet Scientists Researching Another Emerging Livestock Virus

WHEN AN EMERGING INFECTIOUS disease strikes South Dakota and the region's livestock industry, SDSU scientists at the Animal Disease Research and Diagnostic Laboratory (ADRDL) are among the first to investigate. In the last few years, avian influenza and porcine epidemic diarrhea (PED) virus have been two of the national concerns SDSU scientists have helped research and address.

Since summer 2015, a new virus impacting the swine industry has been added to ADRDL researchers' duties. Led by Assistant Professor of Veterinary and Biomedical Sciences Diego Diel (pictured), the team has been studying Senecavirus A, formerly known as Seneca Valley virus.

More than 230 cases of the picornavirus associated with vesicular disease in pigs have been confirmed in the United States since July 2015, he explains.

Historically, one or two cases were diagnosed each year in the United States, but those numbers increased to more than 100 cases nationwide in 2015. That year ADRDL scientists identified several cases in commercial and show pig operations in Iowa, Illinois and Minnesota, along with the first case in a finishing operation in South Dakota.

When the virus emerged in the United States, Diel's research group collaborated with researchers at Embrapa, a state-owned Brazilian Agricultural Research Corporation, to determine the genetic makeup of Senecavirus A isolates from infected herds in the United States and Brazil. In 2014, Brazil experienced an increase in Senecavirus A.

In addition, Diel and his lab investigated how the virus infects and causes vesicular disease in pigs, and how long and in which body secretions affected animals shed the virus to the environment. Both projects were supported by the Swine Health Information Center and USDA Hatch Act funding through the South Dakota Agricultural Experiment Station.

Diel and his colleagues showed that Senecavirus A causes vesicular disease in finishing pigs, thus confirming field descriptions. Affected animals develop blisters, known as vesicles, on the snout, mouth and feet.

"The virus is excreted in oral and nasal secretions as well as in the feces of infected animals," Diel explains. Infected animals begin shedding the virus one day after infection and do so for nearly a month. Researchers have also learned Senecavirus A has a predilection for lymphoid tissues, with the tonsils being one of the main targets of virus replication.

Piglets became lethargic and have diarrhea after being infected with the virus and symptoms persist for as long as 10 days, according to the SDSU study.

Because Senecavirus A symptoms are clinically indistinguishable from foot-and-mouth disease, Diel advises producers to contact the State Veterinarian's Office and send tissue and blood samples to ADRDL to get an accurate diagnosis.

Given the high consequences of foot-and-mouth disease and the similarities to other swine vesicular diseases, Diel says, "We don't want to become complacent." Meanwhile, Diel and the ADRDL team will continue their research to give producers the tools they need to deal with Senecavirus A.

By Christie Delfanian

Affirming ADRDL's Value To Industry

Avian influenza, porcine epidemic diarrhea virus and now Senecavirus—the demand for accurate diagnosis of emerging diseases remains one of the key focuses of the South Dakota Animal Disease Research and Diagnostic Lab (ADRDL).

"ADRDL scientists understand the pulse of the industry and how important it is to get rapid, accurate diagnostic and research data," says Scott Dee, director of research at Pipestone Veterinary Services. The company has 27 veterinarians at three locations—Pipestone, MN, and two Iowa locations. They care for swine, sheep, goats, and beef and dairy cattle.

"It's a culture of service that's very rare in the veterinary profession," Dee points out. The veterinarian and former University of Minnesota professor worked with ADRDL researchers when porcine epidemic diarrhea virus was infiltrating bio-secure swine facilities. They determine that the virus could survive the journey from China in some feed ingredients; however, the PEDV outbreak could not be directly linked to imported feed.

"No one has done this transglobal research," Dee adds.

Editor's Note: To date, ADRDL offers 237 different diagnostic tests and serves more than 1,000 clients a year. The lab has seen a 27% increase in diagnostic testing since 2014.

U.S. Geological Survey

COMMUNITY SUPPORT

Devastating West River Fire Brings Ag Industry Together

FOR ADELE HARTY, OCTOBER 2016 was reminiscent of October 2013. The difference was that one was an experience with fire and the other with ice.

On Oct. 16, a spark near Interstate 90 ignited a fast-moving prairie fire that scorched 40,000 acres of private land and part of the Buffalo Gap National Grassland. Ranchers rushed to cut fences ahead of the Cottonwood Fire to allow cattle to escape, but ultimately 286 cattle succumbed. In the end, the fire left a 16-mile-long black footprint resembling an arrowhead pointing to the west. A total of 22 operations were affected by the fire that also destroyed nearly 200 miles of fencing and some outbuildings, but no family homes.

The facilities and research at the nearby Cottonwood Range and Livestock Field Station operated by the South Dakota Agricultural Experiment Station were also impacted by the fire, with1103 acres of rangeland burned and 11.5 miles of fence destroyed. The station's buildings were not affected, and its staff have served as a community resource during this disaster.

As an SDSU Extension Cow-Calf Field Specialist, Harty offices at the Cottonwood Range and Livestock Field Station, and thus knows the countryside and community of ranchers well. Additionally, Harty has aided this ranch community with disaster relief once before. She says this situation was reminiscent of Winter Storm Atlas, which ravaged the area three years before, killing thousands of cattle still on summer pasture. Some affected by the Cottonwood Fire were also victims of Atlas; just as in 2013, the community pulled together to offer relief.

"A young lady in Philip had posted something on Facebook about helping affected producers. From my past work with Atlas, I know these relief efforts can snowball, so I messaged her about her plan for organizing the effort," Harty says. In the end, she and Sylvia Christen, executive director of the South Dakota Stockgrowers Association in Rapid City, shouldered the job. It was deja vu all over again.

"Sylvia and I wanted to make sure we were on the ground and talked to every

Pictured left: An aerial view of the 2016 Cottonwood Fire shows the arrow-shaped 16-mile area that was burned, which included some rangeland at the Cottonwood Range and Livestock Field Station. *Photo courtesy of US Geological Survey*

producer touched by the fire, evaluate their losses and needs, and determine what resources were available," Harty says. Her first concern was livestock losses, and she also worked with the Animal Industry Board on disposal issues.

"One producer lost nearly half of his cattle in the burned area, while another lost approximately 15%. It was a horrible situation, but one aspect different from Atlas was that FSA had a Livestock Indemnity Program in Place. Thus, we could do verifications on animal losses immediately and producers were paid in a very short period of time," she says.

Philip Charities handled the collection and managing of funds and devised a distribution formula based on fence lost and acres burned. As of early December, $125,000 had been collected. "That's not enough when you look at the total economic impact of this fire, because we're talking $2.5 to $3 million," Harty says.

But generous donations of fencing materials and feed have also been made. "In areas where the fire burned hotter, steel posts and wire were left brittle, while wood posts were completely gone," Harty says. She estimates the fence replacement cost at about $10,000 per mile. Because of its central location, fencing materials have been collected and distributed from the Cottonwood Range and Livestock Field Station. Meanwhile, hay donations have come in from across the state.

"As tragic as this fire was, I've gotten to know some producers better. I think the relationships we've built will help us [SDSU] better serve these people down the road," Harty says.

By Joe Roybal

WRAC WELCOMES NEW DIRECTOR

Kristi (Hiemstra) Cammack is back home and loving it, she says. The new director of the West River Ag Center (WRAC) in Rapid City is an SDSU alumnus with family roots on a Platte, SD, diversified farm, and a husband (Ryan), also an SDSU animal science alumnus, from Union Center. The couple has an eight-year-old son named Jackson and a four-year-old daughter named Baylee.

Cammack earned her BS in Animal Science from SDSU in 1999, and MS and PhD degrees in Animal Breeding and Genetics at the University of Nebraska and the University of Missouri, respectively. She then spent 10 years at the University of Wyoming in a teaching and research position. The associate professor's long-term research focus has been on feed efficiency of livestock.

"My husband grew up near Union Center (located northeast of Rapid City). Family is very important to us and we've always had an interest in being part of the family ranching operation. This job offers me the opportunity to be in administration and work with stakeholders and programs, while still being involved in research. Plus, it's a great fit in terms of location," she says.

As WRAC director, Cammack oversees WRAC, SDSU's two West River research stations – the Antelope Range and Livestock Field Station near Buffalo and the Cottonwood Range and Livestock Field Station near Philip. She also works closely with the SDSU Extension Rapid City Regional Center (RCRC).

WRAC is hailed as the "western front door to SDSU and the College of Agriculture and Biological Sciences." As such, it's long been serving the needs of producers, communities, families and youth in Western South Dakota with expertise in agronomy, animal and range science, leadership and community development, economics, horticulture and 4-H/youth development. But despite its sizeable footprint and storied history, the West River facilities are challenged somewhat in terms of overall identity, Cammack says.

"As a land-grant university, SDSU wants to be sure it is servicing the whole state, and it is certainly doing that. But there is a need to enhance awareness to the fact that our facilities and programs in West River are all part of a single SDSU front. My job is to take what's been built here and continue to build on it by developing relationships that boost our research capabilities and our visibility," she says.

In her first few months on the job, Cammack has been busily acquainting herself with the programs and personnel of WRAC, RCRC and the two research stations. She's also spent considerable highway time making regular trips to the SDSU campus in Brookings.

"I've been in my position for a few months and it's been a steep learning curve, but I've really enjoyed getting to know the professionals here in West River as well as the folks on the Brookings campus. We have many different pieces in many locations, and the challenge is to make sure we're all communicating together and perhaps building new collaborations across the state to better utilize our potential and better serve our constituencies," she says.

By Joe Roybal

Dakota Lakes Research Farm Investigates Three Big Ideas

WHAT WOULD YOU DO WITH ONE MILLION dollars? That's the question Dwayne Beck and board members and staff of the Dakota Lakes Research Farm near Pierre had the opportunity to ponder when the non-profit received a $1 million unrestricted grant from the Howard G. Buffet Foundation in 2015.

Already, the Dakota Lakes Research Farm has established itself as a pioneer in no-till and crop rotation farming methods. What did they want to tackle next? They came up with three big ideas from a list of future priorities they continually update.

One of the big issues the Dakota Lakes team chose to address was a system that would encourage integration of livestock grazing with cropping systems. Thus, development of a self-propelled grazing cell, or some other means of controlling livestock on the land, is being explored.

"A big pen that moves around on its own" is how Beck describes the group's vision for this tool, which could be used on fields to graze crop aftermath or cover crops. Presently, the researchers are working to develop various prototypes using the framework of a lateral-move irrigation system.

Of this concept, Beck explains, "Farming has become automated and mechanized, but that has not been done with livestock on the land…only those in confinement." He suggests development of a self-propelled pen, or a virtual pen with cows equipped with GPS collars, could help reduce labor and better integrate livestock and crop management, along with lowering input costs by moving cattle out of feedlots and into pastures and fields.

Presently, the South Dakota researchers are using portable electric fencing with their existing irrigators in the field in order to graze crop aftermath (mostly cornstalks) and cover crops that were swathed when they were at the maximum quality/quantity in the fall. (Cows on these fields are pictured above.) These cover crops were grown following a wheat grain harvest. The combination of swathed cover crops and corn stalks provides a balanced diet for the animals. Grazing has occurred during fall and winter at the research station in 2015 and 2016, and Beck reports, "It's working very well."

The current research is focused on gathering data related to managing the cattle and the land, determining stocking rates within the pen, and timing on moving the pen. Breed differences are also being monitored to see if grazing or management differences are identified.

For 2016, 120 cows are being grazed using the mobile system. Of those, 98 cows have activity collars on their necks to measure how much time the cow spends eating versus loafing, while 48 cows have pedometers on their hind leg to measure activity and number of steps.

By summer 2017, Beck anticipates a portable cell prototype will be tested. Ultimately, if the GPS collar technology becomes a reality for livestock containment on fields without fences, then Beck believes the mobile prototypes his team is developing may still have applications to supply water, mineral, shelter and shade.

Beck underscores this is a project that will take time to determine the technology and management applications. He concludes, "I think it's a really important project. In the long run, we want to get cattle out of confinement and back on the land. It's good for the cattle and good for the land."

A second futuristic concept being evaluated by the Dakota Lakes Research team involves encapsulated seed balls, which have specialized coatings, to determine if they can be broadcast on a field to effectively plant crops, especially cover crops.

The Dakota Lakes project includes farmers and researchers working in multiple locations to test and fine tune various coating levels and mixes, and particularly timing of broadcast based on growth stage of the primary crop. "We want to determine which application produces the best result," Beck says.

Initial results suggest the best timing application for the cover crop seed balls in an existing sunflower crop is at blossom drop. In corn, it appears to be when the ear is at half milk line.

In 2016, seed was broadcast with airplanes. Beck says knowledge was gained getting pilots comfortable with the process.

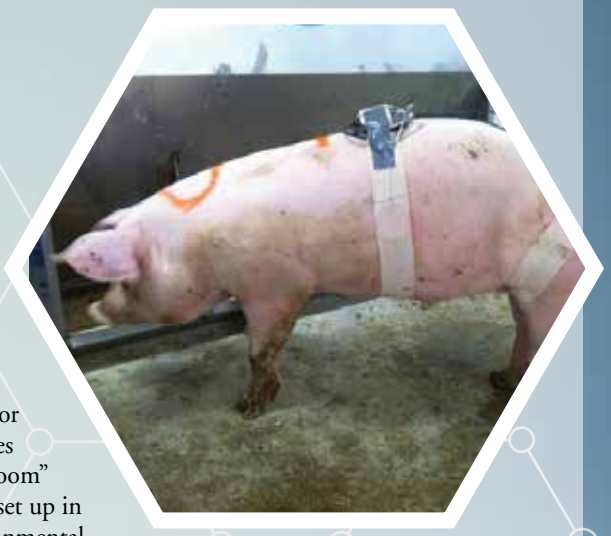
The third concept the innovative Dakota Lakes group is taking a closer look at involves enhancing habitat on public lands and roadsides for birds, pollinators and wildlife. Ducks Unlimited, Pheasants Forever, the SD Association of Towns and Townships, crop commodity organizations, the Department of Transportation, the railroad industry and the Governor's Pheasant Habitat Work Group are all involved in the discussion.

Research in all three areas will continue in 2017. Beck concludes, "These concepts are very applied and multi-disciplinary, and that's what Dakota Lakes has strived to focus on."

Editor's Note: These collaborative research efforts are a partnership between the not-for-profit Dakota Lakes Research Farm Corporation and SDSU. Several funding resources are being utilized in addition to the Buffett grant. Dwayne Beck says the projects encompass efforts by six SDSU scientists, four graduate students and 10 undergraduate students.

By Kindra Gordon

Research in Progress



Swine Study Evaluating Energy Efficiency

A STUDY EVALUATING HEAT FLOW AND ENERGY efficiency is underway at SDSU's new Swine Education and Research Facility. The research is a collaborative effort between the Ag & Biosystems Engineering Department's Erin Cortus and Joseph Darrington and Bob Thaler with SDSU's Animal Science Department.

Cortus explains that the unique temperature-controlled floors of the new facility are making the environmental study possible. The long-term goal of the research is to make pigs more comfortable, and therefore more energy efficient – which can ultimately enhance growth potential.

Cortus explains, "By using temperature-controlled floors, the opportunity exists to provide heating for small pigs in cooler weather, and cooling for larger pigs in warmer weather. The new environmental rooms in the On-Site Wean to Finish Research Unit provide full-scale, one-of-a-kind facilities to conduct this research that has implications around the country."

The first research objective in this project is to evaluate how much heat leaves the pig's body when the pig is lying or standing. Additionally, researchers are evaluating how the animal's heat flow changes when the floor temperature changes.

The initial research project received funding support via a $45,000 National Pork Board grant and $6,000 in local support from the South Dakota Pork Producers.

For this study, Cortus explains that four different floor temperature zones with the same "room" conditions were set up in one of the environmental rooms. In fall 2016, 12 finisher pigs were rotated among these zones. Each pig had sensors attached to four body points, and the sensors were connected to a miniature data logger along the backbone. The pigs spent time in each zone and researchers monitored how the pig was positioned, and recorded the heat flow from the four sensors. Thermal imagery was also used to monitor the conditions around each pig that influenced its thermal comfort.

Cortus says the researchers are now reviewing and analyzing the data that was collected, and intend to use the heat loss information to enhance growth estimation models. In the future, the researchers will look to study the growth and production impacts of altered floor temperature conditions on group-housed pigs.

By Kindra Gordon

Pictured: Heat flux sensors were taped to the side and rear of individual pigs with a data logging system attached along the backbone to gather information on swine heat flow and comfort.

SDSU Research Extends To Alaska

SDSU ASSISTANT PROFESSOR Joshua Leffler in the Natural Resource Management Department is among a consortium of laboratories at five universities around the United States that has received a National Science Foundation (NSF) grant to study the future of caribou forage in northern Alaska.

As the only abundant, large herbivore in the far north, caribou are a critical component of Arctic ecosystems and an important cultural and food resource for local residents, most of whom are Native Alaskans. Leffler explains that climate change is affecting Arctic systems more profoundly than other locations around the world, and temperatures are expected to warm dramatically in the next 50–100 years with associated changes in precipitation.

The scientists will use a combination of experimental data, distributed vegetation sampling, tissue chemical analyses, remote sensing, and snow-cover modeling to build nutritional landscapes for caribou in the present, and in the future, for a study area on the North Slope of Alaska. The NSF Arctic System Science grant will support two SDSU graduate students and several undergraduate students from SDSU's Natural Resource Management Department to work on the project for the next three years.

By Kindra Gordon

Research in Progress, cont.

Grazing Cover Crops Studied To Determine Benefits To Soil, Animal Health

DEVELOPING AN INTEGRATED crop and livestock management system that uses cover crops (such as oats, sorghum, turnips, radishes or millet) planted after harvest for grazing, may be beneficial to improving soil health and protecting the environment. That's the premise behind a four-year, nearly $4 million USDA project, spearheaded by SDSU Assistant Professor Sandeep Kumar of the Department of Agronomy, Horticulture and Plant Science.

"We're expecting [cover crop grazing] to help increase crop production," explains Kumar. The hypothesis is that this system can alter nutrition cycling and improve soil resilience, which may, in the long run, reduce the need for chemical fertilizers.

The National Institute of Food and Agriculture project involves 26 scientists from five universities including North Dakota State University, University of Wisconsin-Madison, University of Nebraska-Lincoln and the South Dakota School of Mines and Technology along with USDA offices in Lincoln, NE; Mandan, ND; and Brookings.

The researchers will assess the impact of incorporating grazing crops at seven sites covering three states—North Dakota, Nebraska, and South Dakota.

The researchers will share their results with producers through a quarterly newsletter, which will be available along with other project information at www.ipicl.org.

By Christie Delfanian

New Innovator Research Grant Awarded To SDSU Animal Scientist

SDSU ASSISTANT PROFESSOR CRYSTAL LEVESQUE (pictured below), faculty member in the Animal Science Department, is one of nine scientists nationwide to receive the inaugural New Innovator in Food Agriculture and Research (FFAR) Award from the Foundation for Food and Agriculture Research.

Levesque will evaluate the dietary requirements of pregnant sows to develop precision feeding recommendations through the five-year, $600,000 grant, which includes an institutional match. Her research builds upon a pilot study in which altering the feed formulation for sows in late pregnancy, known as phase feeding, improved the health of the piglets.

Established through the 2014 Farm Bill, FFAR is a nonprofit organization that leverages public and private resources. The New Innovator grants, given to faculty in the first three years of their career, support creative, potentially transformative research projects that address today's food and agriculture challenges. "Being among this elite group of scientists from universities, such as Purdue, Cornell and Michigan State, shows the innovative nature of Dr. Levesque's research," says Animal Science Department Head Joe Cassady.

Precision feeding means meeting the changing nutritional needs of gestating and lactating sows, Levesque explains. Though extensive work has been done to optimize feed for growing and finishing pigs, much less research has been done regarding sows. The new SDSU Swine Education and Research Facility gives the researchers access to 150 gilts, which they can follow through their second and third pregnancies. Three master's degree and two doctoral students will work on the five-year project.

By Christie Delfanian

Analyzing How Rootstock Affects Grapevine Characteristics

Two SDSU researchers are unraveling how the genetic makeup of the grapevine root and variations in climate affect the characteristics expressed in the stem, leaves and fruit. What they discover may help plants adapt to a changing climate.

Professor Anne Fennell (pictured at right), who has been doing research on cold hardy grapes for more than 20 years, and Assistant Professor Qin Ma, whose expertise is in bioinformatics and computational systems biology, are part of a multi-institutional research team working on the five-year, $4.6 million National Science Foundation project.

The two SDSU Department of Agronomy, Horticulture and Plant Science researchers will receive nearly $830,000 in total funding to support their work. Fennell will focus on data generation, while Ma will do data mining and modeling using computational resources available through the state's collaborative research center, Biosystems Networks and Translational Research and Extreme Science and Engineering Discovery Environment.

Allison Miller, an associate professor in biology at Saint Louis University, is the lead for the NSF project, which also involves researchers from the University of Missouri, Missouri State University, Danforth Plant Science Center and Missouri Botanical Garden in St. Louis, as well as the Grape Genetics Research Unit of the U.S. Department of Agriculture in Geneva, NY.

By Christie Delfanian

Resistant Starch Examined For Beneficial Role In Treating Metabolic Syndrome

METABOLIC SYNDROME INCLUDES a combination of conditions which significantly increases individuals' risk of developing heart disease and Type 2 diabetes.

But SDSU researchers are finding that adding resistant starch to the diets of people with metabolic syndrome can improve bacteria in the gut, which can help lower bad cholesterol and decrease inflammation associated with obesity. Those are the findings of an SDSU research study to examine the prebiotic impact of resistant starch type 4 known as RS4—a nondigestible, chemically modified wheat fiber—in individuals with metabolic syndrome.

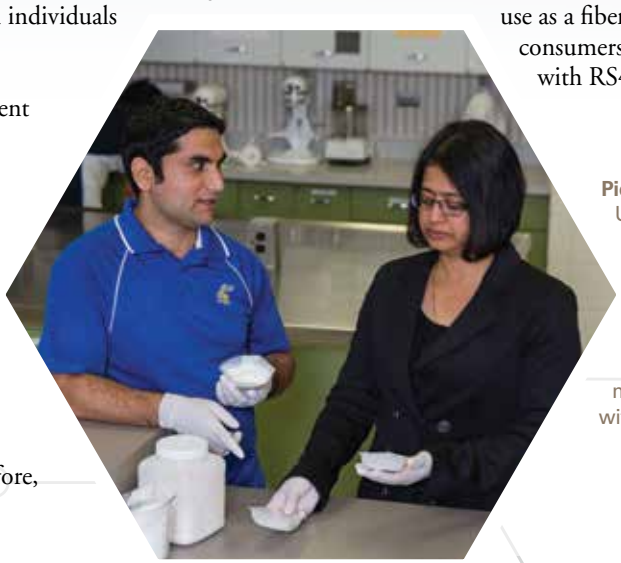
The research was led by Associate Professor Moul Dey of the Department of Health and Nutritional Sciences. Unlike regular starch, RS4 works as a functional fiber, Dey explains. Because it is not broken down in the upper gastrointestinal tract, RS4 is fermented by the gut bacteria in the colon. This produces new substances, such as short-chain fatty acids, that have functions related to health.

"Human bodies harbor more bacterial cells than their own. Therefore, what we eat is not just for us but also for our bacteria," Dey said. "How well we feed them contributes to how well they take care of our health. That's where RS4 can help."

The results were published in June 2016 "Scientific Reports," a Nature Publishing Group academic journal. The research was supported by MGP Ingredients, the National Institutes of Health and the U.S. Department of Agriculture funding through the South Dakota Agricultural Experiment Station.

Currently, RS4 is only available to food manufacturers for use as a fiber ingredient. Dey hopes one day consumers will be able to buy flour fortified with RS4.

By Christie Delfanian



Pictured: Doctoral candidate Bijaya Upadhyaya (left) and Associate Professor Moul Dey of the SDSU Department of Health and Nutritional Sciences examine flour samples used to study the prebiotic impact of resistant starch type 4—a nondigestible, chemically modified wheat fiber—in individuals with metabolic syndrome.

WATER QUALITY QUEST

Understanding E. Coli Behavior Aims To Aid Water Quality In Rivers & Streams

Pictured: To examine *E. coli* levels in Skunk Creek, doctoral student Sadia Salam (left) runs water samples through a filter to collect *E. coli* bacteria under the guidance of assistant professor Rachel McDaniel, a water resource engineer in the SDSU Department of Agricultural and Biosystems Engineering.

BACTERIA LEVELS IN MANY South Dakota streams are too high.

According to the South Dakota Department of Environment and Natural Resources (DENR) 2016 Integrated Report on Surface Water Quality, 78% of the more than 5,800 miles of rivers and streams assessed in the state between October 2010 and September 2015 were impaired, meaning they were unfit for one or more of their designated uses. The most common cause of impairment is bacteria.

To help decrease bacteria levels, South Dakota State University Assistant Professor Rachel McDaniel (pictured right), a water resource engineer in the Department of Agricultural and Biosystems Engineering, and Professor Bruce Bleakley of the Department of Biology and Microbiology are studying the behavior of *E. coli* in sediment and in moving water. Common *E. coli* sources are pets, livestock, wildlife and leaky septic tanks.

"*E. coli* is used as an indicator organism, signaling the presence of pathogens from fecal material," McDaniel explains. Tests to determine *E. coli* levels are fast and accurate. The results indicate the likely presence of more dangerous fecal-borne viruses and bacteria which are hard to screen for, Bleakley adds.

"Typically, *E. coli* cannot survive long outside the host—that's why it was chosen as an indicator," McDaniel explains. However, other researchers have found that sediment can sometimes be a stable source of these bacteria.

Though the projects are in their early stages, the researchers hope what they learn about *E. coli* behavior can help farmers fine-tune management practices to improve water quality in the state's streams and rivers.

Through a three-year, nearly $190,000 grant from the SD DENR, the researchers are examining *E. coli* levels in sediment at Skunk Creek. This impaired creek, which runs from Brant Lake southeast of Madison and flows into the Big Sioux River, is one of the sites targeted through the 2013 National Water Quality Initiative. One doctoral student is also working on the project, which began in July 2016.

"There is no established standard sampling method, so we're trying to come up with one," McDaniel says. Based on previous work, the researchers are taking 25 samples five feet apart at each of five sites, including some of the sites used to compile the surface water report.

Preliminary data showed *E. coli* levels ranging from 30 to 788 colony-forming per gram of sediment in samples from one site, according to McDaniel. Water quality standards for fishing, known as limited contact recreation, allow a maximum of 11.8 colony-forming units per gram of water. "Those who come into contact with water above that *E. coli* threshold are more likely to contract a gastrointestinal illness," she explains.

An additional study is examining turbulence and attachment. *E. coli* attached to larger particles, such as sand and silt, affects the distance the bacteria travel during natural events, such as a rainstorm. Through an annual grant from the Water Resource Institute through the US Geological Survey, researchers are figuring out how these storm events affect water quality. One master's student has been working on this since May 2016.

"When *E. coli* grabs onto large particles, it tends to settle out into the stream bed faster," McDaniel explains. "The unattached bacteria are more buoyant and travel longer distances in the water column."

The researchers track attachment by taking water samples during a storm event. One set of data with samples taken every 30 minutes over a five-hour period showed that only 25% of bacteria readily settled to the bottom. That means 75% of the bacteria stayed afloat for a longer time and have a greater chance of causing impairments to water quality, McDaniel notes.

Understanding how *E. coli* behave in streams will help scientists determine which sources are contributing to high bacteria counts.

By Christie Delfanian

Verifying Ag Land Valuation

Economics And Plant Science Researchers Assist In Reviewing Ag Land's Classification Of Highest And Best Use For Property Taxes

IT'S A TOPIC that's been debated in the South Dakota legislature for several years: Does the assessment process for determining property taxes on agricultural land across the state need to be reviewed and updated?

Presently, the "highest and best use" calculation that is being used in South Dakota is largely determined by the land capability classification from Natural Resources Conservation Service (NRCS) soils data. Currently, all soils are classified into two best use classes: non-cropland or cropland. Many proponents for revising the criteria point out that land use classification does not accurately take into consideration economic factors such as market accessibility, historical yield or weather data, and relative risk and return.

To that end, during the 2016 legislative session House Bill 1007 was passed providing funding for agricultural land production value research. The South Dakota Department of Revenue has contracted with SDSU to conduct this research through 2018, with oversight provided by the Ag Land Assessment Task Force, which is comprised of legislators, assessors, and other appointees.

Matt Elliott (pictured) in SDSU's Department of Economics is a principal investigator for the project. He is joined by Lisa Elliott and Tong Wang, also in the Economics Department, and Doug Malo and a graduate student from the Agronomy, Horticulture, and Plant Science Department.

Elliott explains that the SDSU researchers will use soil, historical weather, topography, and historical yield data in crop growth computer simulations to produce an economic risk and return analysis for every soil in the state. This information will be included in conjunction with a Soil Productivity Rating derived from the NRCS crop productivity index to provide helpful data to the task force as they consider if new assessment methods for ag land valuations should be implemented.

The SDSU research has two components that will combine both soils and economic data.

Plant science researchers will update the soil physically possible test data using new methods and transformations for contemporary yield values. The previous soils data used in ag land valuations dates back to 1990.

Economics researchers will incorporate financial feasibility and maximum profitability test data into their calculations. This will include a simulation of costs and returns data of actual South Dakota farms with capacity of land use, yields, local prices and other factors. For the first time, economic feasibility and maximum profitability will be considered in the land assessment valuation.

Of the effort underway, Elliott explains, "This research is being done in an effort to make the ag land tax classification more accurate. No one method or discipline can provide all of the information, which is why both soils and economic data is being combined… We are trying to take a holistic approach using a classification scheme that includes economics and risk and return with soil productivity."

He adds, "Our position is to provide the research data. Ultimately, it will be the stakeholders who then use that information to make the policy decision as to the method for land tax assessments in the future."

Editor's Note: This research was initiated in June 2016, with the goal to have new data for several counties completed by summer 2017, and all counties in the state completed by spring 2018.

By Kindra Gordon

CATTLE INSIGHT

Fetal Programming Research Evaluates Performance Parameters

DOES A NUTRITIONAL RESTRICTION to a pregnant female create permanent changes to the unborn fetus that affect how that individual will perform throughout its entire life? That's the premise behind fetal programming research being conducted around the world with both humans and animals.

Findings from several bodies of research suggest that certain environmental factors can indeed reset physiological parameters of the fetus that influence physical attributes and health into adulthood. While scientists have begun to better understand this emerging area of study, a great deal more remains to be learned.

At SDSU, several fetal programming research studies with a focus on cattle have been conducted over the last several years. The most recent study, conducted with funding from the South Dakota Beef Industry Council, involved collaboration among SDSU Animal Science faculty members Amanda Blair, Ken Olson, Keith Underwood, and Michael Gonda, University of Nebraska researcher Rick Funston, and SDSU Animal Science graduate students Janna Kincheloe and Megan Webb.

Olson explains that as fetal programming knowledge and research is advancing, new studies are looking at manipulating–usually restricting–specific nutrients such as energy, protein, or certain types of minerals. Additionally, scientists are evaluating the effects of timing of dietary restrictions during gestation.

The research question evaluated in the latest SDSU study was focused on the impact of a protein restriction in pregnant first-calf heifers' diets. Progeny from those heifers were then monitored through the beef production cycle and evaluated for feedlot and carcass performance.

A total of 108 females were in the research trial conducted at the Cottonwood Range and Livestock Field Station near Philip, SD. The bred heifers were divided into four groups with a protein restriction implemented in mid-gestation, late gestation, or throughout both mid- and late gestation. There was also a control group that experienced no protein restriction throughout gestation.

The researchers explain that a protein restriction in mid- to late gestation was chosen because it can be representative of a real ranch setting. With cows on dormant range or corn stalks prior to calving, protein may be limited in their diet during the second and third trimester.

The 108 females were bred in June 2013 and experienced their protein restriction during gestation and prior to calving in March 2014. That was the only time the females experienced any kind of dietary restriction. Heifers were weighed and body condition scores were evaluated at the beginning and end of each gestational period, with ultrasounds conducted to evaluate heifer body composition at the same time points.

When calves were born in March and April, data was collected on birth weights, calf vigor, and calving difficulty. Additionally, within 48 hours after birth muscle biopsies were collected from 12 calves–three within each treatment group. This was done to evaluate gene expression using next generation sequencing (RNA-Seq).

Following calving, pairs were managed as a common group in a typical range-based production setting through weaning. All calves were weaned and preconditioned for two weeks in October 2014 before being shipped to North Platte, NE. The University of Nebraska-Lincoln West Central Research and and Extension Center's GrowSafe feeding system collected feeding data for each individual animal. Calves were fed a typical finishing diet, and feed intake, average daily gain, and feed efficiency were evaluated. Two weeks prior to harvest, muscle biopsies were again collected on the same 12 head that were sampled at birth. This allowed researchers to determine if changes in gene expression were maintained over time. All steer and heifer progeny were harvested in 2015 at the Tyson plant in Lexington, NE, with carcass data collected including hot carcass weight, ribeye area, fat thickness

"Additional fetal programming research is needed to determine more about how nutrients flow from the dam to the fetus and how various developmental processes are affected..."

– Amanda Blair, SDSU Meat Scientist

and marbling scores. Yield Grade and Quality Grade were calculated for each carcass.

To evaluate meat quality, a strip loin was collected from each carcass to determine Warner-Bratzler Shear Force (measure of tenderness) as well as the fatty acid profile. Rib sections were also collected from a subsample of carcasses to determine the impact of gestational treatments on carcass composition.

Pregnant heifers that experienced a protein restriction at various periods throughout gestation lost weight and condition compared to heifers on the control diet. In addition, ultrasound measurements indicated that restricted heifers lost ribeye area, indicating that body stores were being mobilized in response to the protein restriction. Despite impacts on heifer performance, there were no differences in birth weight or weaning weight of progeny due to the dam's nutritional treatment. In addition, there were few differences in feedlot performance, carcass composition, and meat quality characteristics among offspring.

However, the researchers did find differences in gene expression based on muscle biopsies collected at birth. Blair explains that in progeny that received a protein restriction during gestation, "Genes involved in muscle tissue development were down-regulated and genes involved in fat development were up-regulated or turned on."

Thus, the researchers say they might have expected smaller carcasses with reduced ribeye areas and more fat from those progeny. However, the differences identified in the genome were not consistent with carcass characteristics and meat quality. While the exact mechanisms responsible for the responses observed in this trial are yet to be determined, it is possible that these processes were further influenced by external factors such as environment or that observed genetic differences may have resulted in phenotypic changes later in the animal's life. It also appears that metabolic and/or physiological mechanisms may have allowed the dam to absorb most of the impacts of the restriction herself through mobilizing body stores, thus protecting her unborn calf from the nutritional insult, suggests Olson. Additionally, when nutrition returned to normal following calving, cows recovered and no differences were detected in breed back percentages.

For cattle producers, Olson and Blair underscore that the take away from this research is not that protein supplements are unnecessary. They point out that it is important to consider that this study was conducted over one production cycle using a group of cows from a common genetic background. And Blair explains, "Responses may not be consistent if a different type of cattle were fed under alternate environmental conditions and study parameters."

The researchers say it is also noteworthy that diets for this study were formulated to meet energy requirements for all heifers, with protein being the only restricted nutrient. Energy deficiency may result in impacts on cow and calf performance that were not observed in this study, Olson says. Based on a large body of previous research, he also advises that producers should meet protein and other nutrient requirements of pregnant females in order to ensure optimal calf health and subsequent reproductive performance of cows.

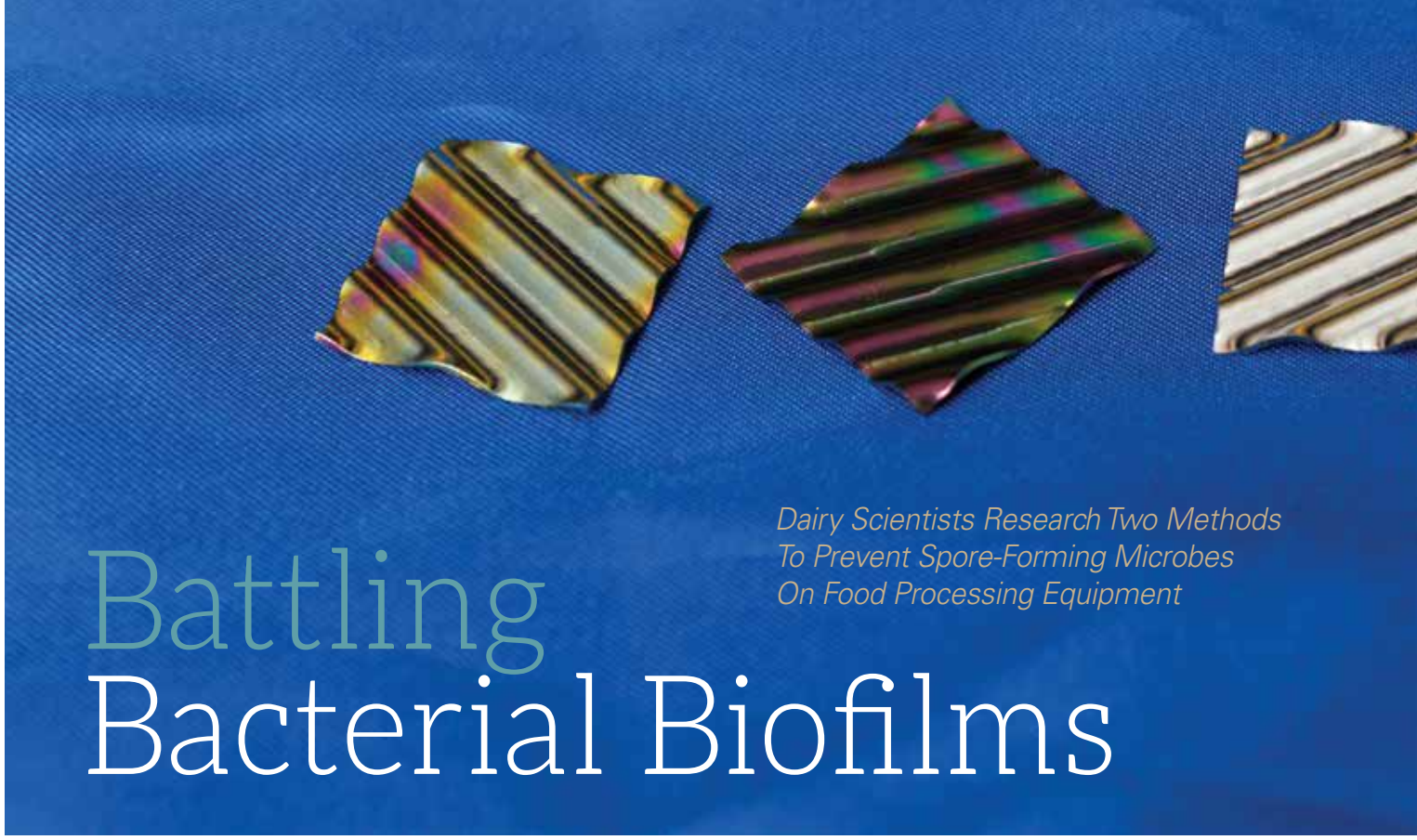
Picture at left: Cattle at the Cottonwood Range and Livestock Field Station were utilized for a fetal programming study following calves from birth through the harvest phase. **Above:** SDSU Meat Scientist Amanda Blair shares information about fetal programming research with producers gathered at the annual field day held at the Cottonwood Range and Livestock Field Station.

With continued research, these scientists hope to gain a better understanding of how cattle respond to various conditions experienced during gestation and how this impacts lifetime performance and production of livestock.

As one example, Blair shares that a study conducted by another research group indicates that a restriction in mid-gestation may affect formation of reproductive organs of progeny and could have negative impacts on fertility. Although reproductive response of heifer offspring was not evaluated in this particular study because all heifer offspring were harvested to determine impacts on carcass characteristics, this is an issue of extreme importance to producers.

"Additional fetal programming research is needed to determine more about how nutrients flow from the dam to the fetus and how various developmental processes are affected based on maternal diet," Blair says. "Increasing our understanding of nutrient requirements at various stages of gestation will be important in guiding nutritional management strategy recommendations for livestock producers in the future."

By Kindra Gordon



Dairy Scientists Research Two Methods To Prevent Spore-Forming Microbes On Food Processing Equipment

Battling Bacterial Biofilms

FOR NEARLY A DECADE, South Dakota Agricultural Experiment Station researcher Sanjeev Anand has been waging war against microbes, especially spore-forming bacteria that colonize and form biofilms within milk-processing equipment. The SDSU dairy science professor is fighting the battle on two fronts—testing modified equipment surfaces that prevent biofilm formation and identifying enzyme cleaners that can remove organisms embedded in filters.

It's a two-pronged approach, but the goal is the same—to improve the quality, safety and marketability of dairy products.

High levels of spore-forming microbes, some of which can even survive pasteurization, adversely affect the flavor, texture and shelf life of milk products, such as cheese, yogurt and milk powders. Consequently, manufacturers must meet national and international food quality and safety guidelines for microbe levels in milk products, which then impacts their marketability.

To compete in a global market, milk powder exports, for instance, must have spore counts below a specific level, Anand explains. His research is supported by grants from the National Dairy Council and the Midwest Dairy Foods Research Center, along with active partnership with US Dairy Export Council.

One focus of Anand's research is on equipment surfaces. "Modifying the stainless steel surfaces can help prevent the microbes from attaching to the equipment and make cleaning easier," he explains. Some of these bacteria also resist conventional cleaning methods, and this leads to development of resistant biofilms. Once these biofilms form, they keep shedding organisms contaminating subsequent products and requiring more frequent equipment cleaning and, in some cases, making equipment replacement necessary.

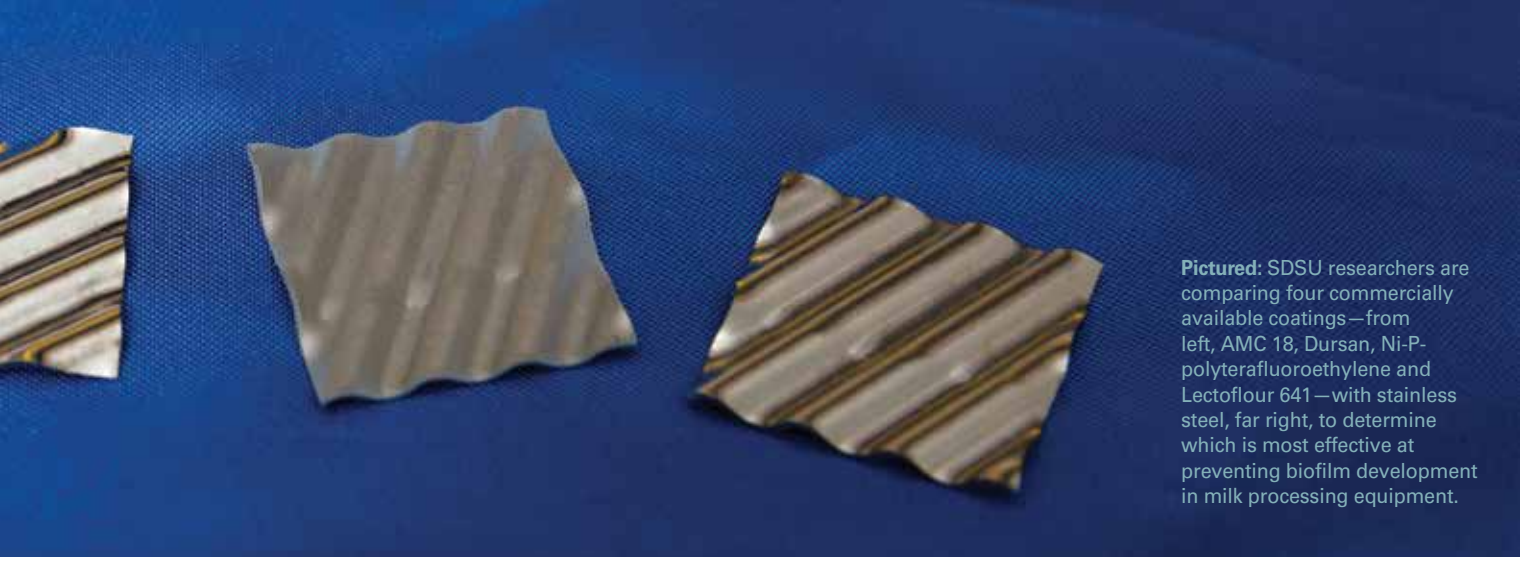
SDSU graduate student Shivali Jindal conducted a study to determine which of four commercially available coatings is most effective at preventing microbe buildup and biofilm formation on heat exchanger plates. To do this, she used three spore-forming *Bacillus* species commonly encountered in the dairy environment.

The SDSU team collaborated with researchers at the University of Massachusetts-Amherst and Kansas State University on this project. Their results were published in the December 2016 "Journal of Dairy Science" with the article earning the "Editor's Choice" designation.

The Ni-P-polytetrafluoroethylene coating produced the best overall results, meaning fewer bacteria adhered to the treated surface, according to Jindal. She then identified which surface properties helped prevent the microbes from attaching. "If surface energy is less, fewer bacteria will attach to the surface, resulting in less biofilm formation," Jindal says. Anand compares lowering surface energy to putting powder on a Carrom board—the rings slide more easily across the board. "When friction goes down, the affinity to attach goes down," he says.

Conversely, an increase in hydrophobicity—the tendency of a droplet to maintain its shape, much like raindrops on a freshly waxed car— makes it more difficult for bacteria to attach. "Teflon is very hydrophobic," points out postdoctoral researcher Nuria Garcia-Fernandez. "It alters the way the droplets interact with the material."

According to the December 2016 article, Lectrofluor 641 coating exhibited low surface energy and high hydrophobicity. However, the researchers found that surface roughness did not affect bacterial adhesion. Though somewhat unexpected, Anand says, "This is an area that people are trying to understand."



Pictured: SDSU researchers are comparing four commercially available coatings—from left, AMC 18, Dursan, Ni-P-polyterafluoroethylene and Lectoflour 641—with stainless steel, far right, to determine which is most effective at preventing biofilm development in milk processing equipment.

Pictured left: Professor Sanjeev Anand and postdoctoral researcher Nuria Garcia-Fernandez mount pieces of filtration membrane for a project to develop a combination of enzymes that will remove organisms that clog the fine pores of these membranes in food manufacturing equipment. **Above**: Professor Sanjeev Anand and graduate student Shivali Jindal examine two specially coated specimens to evaluate prevention of biofilm buildup.

The second focus of the SDSU dairy science researchers is identifying enzymes to remove organisms that attach to filtration membranes in food-manufacturing equipment. These membranes have microscopic pores which can remove fat or lactose and even concentrate proteins, explains Garcia-Fernandez who is overseeing this project. As the pores become clogged, more pressure must be applied to force the liquid through the filtration system.

In particular, she is looking at organisms that excrete extracellular polymeric substances—carbohydrates, protein and compounds that act as a glue-like substance and adhere to surfaces. "These bacteria are the toughest to get rid of," Anand says.

Developing an effective solution to clean these membranes will save food processors time and money. "We want to maximize the life of those membranes so we don't have to replace them as often," Garcia-Fernandez says.

Some of these organisms are used for products, such as cheese and smoothies, Anand explains. "For example, we deliberately use a culture which produces extracellular polymeric substances to create smooth, drinkable yogurt and low-fat cheeses to achieve the desired mouth feel and body."

However, he points out, the side effect of using this culture shows up when the whey is filtered for other uses.

For more than five years, Garcia-Fernandez has been characterizing these filter-clogging organisms. "If we understand the biofilm structure better, we can use targeted enzymes," she explains.

To formulate the enzyme-based cleaning solutions, the researchers are collaborating with Ecolab in St. Paul, MN. "We decide which enzymes and they help us with the formulation chemistry," says Garcia-Fernandez. Then the SDSU researchers evaluate the formulation's effectiveness.

Ecolab senior scientist Paul Schacht and principal chemist Cynthia Bunders add, "It's been a very positive experience to collaborate externally with the dairy research experts from SDSU with the goal of developing new knowledge and solutions to help solve real-world customer problems."

"This is a very nice collaborative project," says Anand, noting that these application projects will hopefully change the way things are being done—and help provide solutions to reduce biofilm formation, which will ultimately enhance food quality and safety.

By Christie Delfanian

BEAVER BENEFITS

SDSU Ecologist Writing Book About Beaver Impacts On Landscapes

AS SOUTH DAKOTA STATE University professor Carol Johnston points to streams scattered across a map of the Kabetogama Peninsula in northern Minnesota, she says, "All these areas have beaver ponds at the headwaters." The map will be one of the illustrations in a book the ecologist is writing about beavers, which she refers to as "ecological engineers."

Through a $143,600 National Science Foundation grant and USDA Hatch Act funding through the South Dakota Agricultural Experiment Station, Johnston and her collaborators are writing a book titled *Beavers: Boreal Ecosystem Engineers*. Johnston has been conducting NSF-funded research on beavers since the 1980s.

The book examines how beavers have affected the ecosystem at Voyageurs National Park near International Falls, MN. While it is specific to Minnesota, the information will have applications to beaver populations and landscape effects around the globe.

Johnston is writing nine of the book's eleven chapters, with University of North Dakota biology professor and ecologist Isaac Schlosser and Voyageurs National Park terrestrial ecologist Steve Windels each contributing a chapter. The manuscript will be finalized in summer 2017 and the book will be published by Springer Publishing.

Johnston is a fellow of the Society of Wetland Scientists and served as its first female president in 1992. She was also the first female chair of the Soil Science Society of America's Wetland Soils Division.

Beavers alter the landscape in ways that decrease runoff and provide habitat for other organisms, Johnston explains. "Beaver ponds provide storage sites for water, particularly snow melt, that might otherwise run downstream quickly. By inserting ponds here and there in the landscape, they help connect habitat for semiaquatic organisms, like frogs." In addition to ducks, amphibians, moose and upland mammals use this habitat extensively.

Pictured: SDSU Professor Carol Johnston stands atop a beaver lodge in the inlet to Little Pequaywan Lake near Duluth, MN. Through a National Science Foundation grant, she is writing a book titled "Beavers: Boreal Ecosystem Engineers."

"Beavers influence the environment at a rate far beyond what would be expected given their abundance," she says.

The book describes the vegetative, water, soil and biogeochemical alterations associated with beaver impoundments. It begins by looking at how the beaver population recovered from overtrapping in the early 1900s.

Historical and aerial photos from 1927 and 1940 showed solid forests, meaning little evidence of beaver activity, according to Johnston. However, from the 1940s through the 1980s, the beaver population in the nearly 218,000-acre national park increased steadily.

By 1986, 13% of the Voyageurs National Park landscape was impounded by beavers. "We saw lots of ponds where before there were none," she says.

Aspen is the preferred food, Johnston explained, noting beavers don't hibernate and must rely on having a large supply of edible food in their underwater cache to survive the winter.

Beavers forage up to 110 yards from the pond edge, creating what Johnston calls a "bathtub ring of conifers" when most of the aspen and deciduous trees have been harvested. Venturing beyond that comfort zone makes beavers susceptible to predators.

Since 1991, the beaver population has been decreasing; predation and depleted food supply may account for the decline. Thanks to the National Park Service officials mapping active beaver lodges, she can relate the population data to changes in the landscape.

"It's unusual to have both those types of data for such a large area," she says. That has allowed her to track what happens to the landscape when beaver numbers are reduced.

Though Johnston admits beavers' engineering skills aren't always appreciated, she adds that their resilience, which she documents throughout the book, is undeniable.

By Christie Delfanian

ADDRESSING OBESITY

Diet & Physical Activity Of Children Focus Of Continuing Research

OBESITY IS A TOP HEALTH concern across the nation—as well as in South Dakota. To learn more about intervention strategies to address obesity, SDSU researchers in collaboration with SDSU Extension specialists are focused on unique research on children within the state.

The research is being conducted within SDSU's Department of Health and Nutritional Sciences by Assistant Professor Lacey McCormack and Associate Professor Jessica Meendering with funding support through the South Dakota Agricultural Experiment Station and the USDA Hatch Act.

Specifically, McCormack and Meendering are looking at the environment children are in—at school and home—to determine what factors may be contributing to childhood obesity. They are also comparing the environment of rural children to non-rural children.

McCormack explains that because children do what is around them, their environment shapes their behavior. She adds, "If we can change the environment, we can eventually change the behavior."

Their research began with a literature review looking at all of the work relating to diet and physical activity patterns comparing rural and non-rural children. The researchers found that there is not as much research on rural child obesity—or rural children in general. While previous research indicates a disparity does exist between the two groups with regard to obesity, it is not clear what behaviors are contributing to this disparity.

The SDSU researchers' paper was published in the "Journal of the Academy of Nutrition and Dietitics." This initial research was focused on "laying the foundation for the need to do more work studying childhood obesity factors, particularly in rural areas."

McCormack explains, "The main finding of our literature review was that we need more studies, and high quality studies, comparing rural versus non-rural children to understand how diet and physical activity are contributing to this disparity, and regarding what is shaping those diet and physical activity behaviors."

As a follow-up to their literature review, the duo conducted a pilot project assessing school and home environment differences in diet and physical activity of rural and non-rural children. Surveys were gathered with input from students, parents and school administrators and staff in one rural school and one non-rural school in South Dakota. The higher obesity rates among rural children were affirmed, and comparisons were made between rural and urban children's diet and physical activities.

McCormack notes that it was difficult to pinpoint specific contributing factors among diet and physical activity between the two research groups, but she notes that the pilot project showed that students, parents and schools were willing to be involved and share information for the research.

She adds. "We learned we are on the right track. The information from the pilot project will guide the future work we do."

For 2017, McCormack and Meendering will continue to research factors that contribute to childhood obesity by evaluating school wellness efforts across the state.

Meendering explains the project will assess how strong and comprehensive school wellness policies are, if they align with national standards, and to what degree the written policies are being implemented and evaluated. The project aims to evaluate how a school wellness policy shapes the school environment related to student nutrition and physical activity choices.

SDSU Extension Food and Families Program Director Suzanne Stluka says the effort reflects the collaborative land-grant mission of addressing the needs of communities. "Working together we are linking research and measurability with extension's outreach arm to school and communities," she states.

Ultimately, the goal will be to find and amplify school wellness programs that are effective in helping students make healthy life choices into adulthood.

By Kindra Gordon

Research Recognition

SDSU Doctoral Student Studying Soybean Root Rot Receives First McFadden Scholarship

SDSU student Paul Okello (pictured) is the first recipient of the newly-created Edgar S. McFadden Graduate Student Scholarship in Plant Science. Okello, who is in the second year of his doctoral studies, is conducting research on root rot caused by *Fusarium* species and their interaction with soybean cyst nematode on soybean.

Using South Dakota field samples, Okello has identified 10 *Fusarium* species that cause root rot and is screening soybean germplasm to help breeders develop resistant varieties. This work is supported by the South Dakota Soybean Promotion and Research Council and the North Central Soybean Research Program. His research adviser is assistant professor Febina Mathew, a field crops pathologist.

The $3,000 scholarship is sponsored by the Foundation Seed Stock Division, South Dakota Crop Improvement Association and South Dakota Wheat Commission. It is awarded to a graduate student whose work focuses on plant breeding and/or pathology.

Using soybean germplasm from the U.S. Department of Agriculture, Urbana, IL, Okello is screening 246 plant introduction soybean lines belonging to early maturity groups for tolerance to the *Fusarium* species.

A few commercially-grown soybean varieties in South Dakota are tolerant to *Fusarium virguliforme*, which causes sudden death syndrome. However, breeders have yet to develop cultivars that can tolerate the other nine *Fusarium* pathogens.

In his preliminary experiments, Okello has identified 13 soybean genotypes with possible resistance to *Fusarium proliferatum*, the most aggressive of the root rot pathogens, and at least one that may have resistance to four *Fusarium* species. These soybean lines may be used as parent material to develop commercial soybean cultivars with resistance to *Fusarium* species.

By Christie Delfanian

SDSU Graduate Student Earns National Cattlemen's Foundation Scholarship

Megan Webb (pictured), an SDSU meat science graduate student, recently received the prestigious W.D. Farr Scholarship from the National Cattlemen's Foundation (NCF). Webb joined the Animal Science Department as a graduate research assistant in January 2015 to pursue her Ph.D.

The $12,000 scholarship is awarded to two recipients annually to honor W.D. Farr, a third generation Coloradan dedicated to improving agriculture, livestock, and water development.

While at SDSU, Webb has been involved in several meat science research projects focusing on the impacts of pre-harvest management on end-product quality. Her most recent project has involved establishing a multi-disciplinary team of researchers, including experts beyond SDSU, to study consumers' response to beef raised with and without common production technologies, such as antibiotics, implants, and beta-agonists. Ultimately, the goal of the study is to determine if there is a preferred marketing language depending on production method, and if consumers have a preference in beef palatability and willingness-to-pay. Further, live cattle performance and economic data will be analyzed to guide producers when making production decisions.

Webb credits her doctorate advisor, Amanda Blair, SDSU meat science associate professor, for guiding her development as a researcher. She also appreciates the support of all the professors involved in the projects she has worked on at SDSU and says, "As a graduate student, the best part about the Animal Science Department is the collaborative opportunity."

A native of Burlington, West Virginia, Webb, received a Bachelor's Degree in Animal Science with a Meat Science Certification from Texas A&M before earning a Master's Degree at Colorado State University in 2014. She plans to receive her PhD in December 2017 with the hope of obtaining a liaison position in the beef industry to improve transparency and build consumer trust.

By Wendy Thorstenson

New Method For Predicting Bread Loaf Volume Earns SDSU Scientists International Award

A new method for predicting bread loaf volume without baking has earned a team of SDSU scientists a research award from the American Association of Cereal Chemists International.

Food science professor Padu Krishnan (pictured far right) and former doctoral student Julie Kindelspire (pictured center) worked with plant breeders Kal Glover (wheat) and Melanie Caffe-Treml (oats) to determine which varieties of wheat make the best bread.

As part of the project, Kindelspire, now a senior research scientist at POET, developed a mathematical model that uses specific dough parameters to predict loaf volume. The research was supported by the SD Wheat Commission and U.S. Department of Agriculture Hatch Act funding through the South Dakota Agricultural Experiment Station.

"It's a shortcut," Kindelspire explains. "What once took 11 equations to calculate, now takes one." The results were published last year in the *Cereal Chemistry* journal.

The researchers received the Texture Technologies Quality Research award last fall and a $1,000 honorarium.

"It's a very big deal," says Krishnan, who notes that the "holy grail of the baking industry is loaf volume—the bigger the volume, the better." For the project, the food scientists examined 19 genotypes of hard white and red spring wheat grown in several years at six South Dakota locations.

"To get good volume, you need to look at the air cells inside the dough," Krishnan explains. Specifically, sifting the flour, mixing it with water and kneading incorporate air into the

dough—this process creates bubbles that expand from the carbon dioxide from the yeast.

Kindelspire discovered a correlation between the dough's ability to stretch and the stability of the walls of the gas-filled bubbles. "I found a relationship between dough extensibility and how it relates to strain hardening," she says. A higher strain hardening index is better for loaf volume.

Researchers can now use this simplified process to tell the breeders which wheat varieties have better baking potential. "Breeders want me to look at the flour and tell them if this variety is good—now we have a faster way of doing that," Krishnan says.

By Christie Delfanian

New Winter Wheat Variety, Oahe, Offers High Yields, Disease Resistance

High yields and an excellent disease resistance package—these are qualities producers can expect from Oahe, the new winter wheat cultivar released by the South Dakota Agricultural Experiment Station (SDAES).

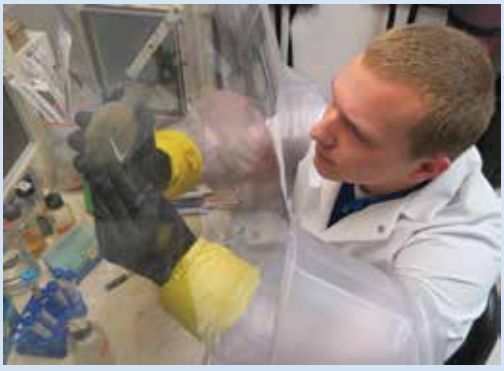
Bill Gibbons, SDAES interim associate director, says, "Oahe represents the latest in a long line of wheat releases that our researchers have developed to support the wheat industry in South Dakota and the region."

From 2013 to 2015, Oahe ranked No. 1 in mean grain yield among hard red winter wheat trials in the North Regional Performance Nurseries, which has test plots from northern Kansas through Montana and into Canada.

Assistant Professor Sunish Sehgal, who is the SDAES winter wheat breeder, estimates that Oahe yields are one to two bushels more per acre than the average performance of other SDSU varieties. The new variety also has good resistance to stripe rust, leaf rust and wheat streak mosaic virus, along with resistance to fusarium head blight that is comparable to other popular varieties. The new variety is now available to certified seed growers. By 2017, producers should be able to purchase it through the dealers listed in the South Dakota Certified Seed Grower Directory.

SDSU's winter wheat breeding program is supported by the South Dakota Wheat Commission through checkoff funding, the USDA National Institute of Food and Agriculture and the U.S. Wheat Barley Scab Initiative.

By Christie Delfanian



SDSU Biology Student Earns National Research Scholarship

A junior biology major from De Smet is the first SDSU student since 2011 to receive the Goldwater Foundation Scholarship for scientific research.

Andrew Foley, (pictured at left) who is enrolled in the Van D. and Barbara B. Fishback Honors College, works with assistant professor Joy Scaria of the Veterinary and Biomedical Sciences Department to identify species of gut bacteria that can help treat the intestinal infection caused by *Clostridium difficile* or *C. diff.*

The Goldwater Scholarship recognizes outstanding achievement and potential for meaningful contributions to scientific research on the national level. Since 2000, only five SDSU students have won the Goldwater scholarship, which provides up to $7,500 per year for tuition and fees.

The researchers' goal is to develop probiotic mixes in a pill form that will inhibit the growth of *C. diff.* and help return the patient's gut microbiome to normal.

By Christie Delfanian

COLLEGE NEWS

Doerner Announced As Interim Vice President Of Research And Economic Development

Kinchel Doerner, current dean of the Graduate School at SDSU, is now serving as the interim vice president of research and economic development. Kevin Kephart, who has been dean since 2005, will retire from SDSU in June 2017.

Doerner came to SDSU in 2012 as Dean of the Graduate School. He also holds a position as Professor of Biology and Microbiology. Previously, Doerner spent 16 years at Western Kentucky University.

Doerner's research portfolio includes numerous grants from the USDA and the National Science Foundation. Additionally, he has published dozens of national and international abstracts and peer-reviewed publications. He was a visiting scientist in 1989 in the Department of Biochemistry at the Cambridge Research Station in Cambridge, England.

In addition to continuing as dean of the Graduate School, Doerner will oversee the Division of Research and Economic Development that includes research administration, compliance with state and federal regulations, federal government relations, technology transfer and economic development.

Plant Disease Knowledge Shared

Students lead plant disease and pest outreach program to Native Americans

Students became the teachers this past summer when four SDSU graduate students in the Department of Agronomy, Horticulture, and Plant Science utilized a $1,000 grant to share their knowledge of plant diseases and pests with Native Americans involved in the community garden initiative on the Pine Ridge Indian Reservation.

The one-day workshop was held in June 2016 and was organized in collaboration with SDSU's Extension Native American program and Little Wound School FACE Program in Kyle, SD. SDSU graduate students leading the project included Paul Okello, Taylor Olson, Phillip Alberti, and John Posch.

The students discussed diseases, insects and other pests affecting sweet corn, tomato, potato and pepper, which are commonly grown in community gardens. The diseases and other pests discussed included corn smut, common corn rust, bacterial spot of pepper, early blight of potato, late blight of tomato, aphids, thrips, raccoon, bird, sun scald, and blossom end rot of tomato and pepper. Effective watering, drip irrigation, and mulching techniques were also discussed.

Those participating acknowledged that their awareness and skills were improved from the workshop, and the SDSU students are now working with SDSU personnel to prepare factsheets on diseases and pests of sweet corn, tomato, potato and pepper that will eventually be available to Native Americans and the community-at large.

SDSU plant pathologist Febina Mathew, who advises the four SDSU graduate students involved in this program, notes, "This kind of outreach is a great experience for graduate students to teach others and foster the betterment of humanity. It's for a good cause."

Grant funds that made this effort possible were from the APS Mathre Education Endowment Award from the American Phytopathological Society Foundation.

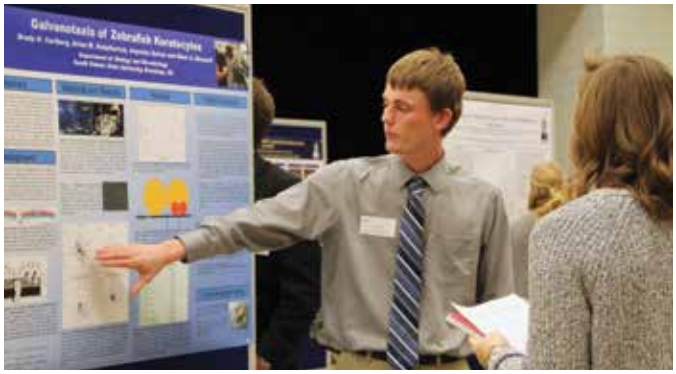
Pictured: SDSU graduate student Taylor Olson (far left) answers plant disease questions from community garden participants at Pine Ridge.

SDSU

UPCOMING EVENTS

March 31 – April 1, 2017
SDSU 94th Annual Little International

May 6, 2017
SDSU 131st Annual Commencement



Biology & Microbiology Day of Scholars Showcases Student Experiences

Each spring and fall the Biology & Microbiology Day of Scholars event showcases the research, internship and externship experiences of undergraduate and graduate students in the SDSU Biology and Microbiology Department.

Students spend a semester (or more) conducting research, field work or internships and then, at the Day of Scholars, share their findings and experiences with peers and faculty. Poster presentations and a question and answer session with panelists encompass lab-based research in genetics, microbiology, cellular biology and applied biofuels, and also includes student learning and findings from field work, internships in teaching, business, industry and healthcare.

The Day of Scholars was started in the Spring of 2013 and now boasts 100-plus presenters and more than 200 faculty and students in attendance each semester. The next Day of Scholars is set for April 26, 2017.

Ceres Celebrates New Chapter House

Ceres Women's Fraternity celebrated 25 years of sisterhood at SDSU with a ribbon cutting at the new chapter house on Nov. 19. The day was for celebration and reflection.

Event speakers included Wes Tschetter, Vice President of Finance and Administrative Services, Secretary of the State College Development Association, and a FarmHouse Brother; Dr. Barry Dunn, SDSU President; Nichole Woizeschke, SDSU Ceres Alumnae Association President; Erin Wicker, SDSU Ceres Chapter President; and Angela Loftesness and Stephanie Kontz-Myers, the New House Committee Co-Chairs. Following speeches, the active chapter members hosted tours of the new house, which is the remodeled and repositioned former FarmHouse.

The new house is home to 18 women with individual bedrooms, an office, large kitchen, and common spaces for meetings and building the bonds of sisterhood.

By Katherine Brandtjen, Ceres outreach chair

Educate To Career Inc. has named South Dakota State University a 2017 Top 100 Best Value College. The designation applies to the first 100 colleges out of the nearly 1,200 colleges and universities ranked. South Dakota State is No. 65 in the 2017 rankings, climbing from No. 113 in 2016. The 2017 ETC College Rankings Index's methodology uses data and analytics to rank schools by economic value created for their students. The index identifies the colleges that are graduating students and preparing them for the labor market.

"The schools in the top third of our rankings are doing a good job for their students, while those in the bottom third need improvement," explains Michael Havis, president of Educate To Career Inc. "Using our outcome-focused methodology, the index empirically determines the economic value added by each of the over 1,000 colleges ranked within our system—unlike other rankings that rate colleges based on the academic caliber of their students."

Notable Discovery & Naming

New Virus Officially Named influenza D, As SDSU Researchers Proposed

IT'S OFFICIAL. The executive committee of the International Committee of Taxonomy of Viruses approved naming a new virus, influenza D, as the South Dakota State University researchers who discovered it proposed. The committee officially announced a new genus, *Orthomyxovirdae*, with a single species, influenza D virus, because of its distinctness from other influenza types—A, B and C.

Although SDSU alumnus Ben Hause isolated the virus from a diseased pig in 2011, he later found that cattle were the primary reservoir for influenza D. Hause identified and characterized the new virus as part of his doctoral research under SDSU Professor Feng Li (pictured above).

This is the first influenza virus identified in cattle. "This contribution was made in South Dakota and our theory has been confirmed independently by other research groups," notes Li.

Li and Radhey Kaushik, Professor and assistant head of the SDSU Biology & Microbiology Department, secured a National Institutes of Health grant for nearly $400,000 to study the biology, genetics and evolution of the new virus. The researchers underscore that, to date, the virus has not been shown to be pathogenic in humans.

"From a science viewpoint, it's very exciting to work with a brand-new virus," says Li, who has joint appointments in the Biology & Microbiology and Veterinary & Biomedical Sciences Departments. He adds, "We have much to learn about this new virus."

Volker Brözel, head of the Department of Biology & Microbiology, says, "This is a great example of how our researchers add to scientific knowledge and seek solutions to challenges impacting both human and animal health." He also praised the researchers for actively engaging both graduate and undergraduate students in the research discovery process.

By Christie Delfanian

SDSU Doctoral Student Earns Scholarship For Influenza D Research

Continuing research on the new influenza D virus that affects pigs and cattle helped SDSU doctoral student Chithra Sreenivasan (pictured below) earn the Joseph P. Nelson Graduate Scholarship Award. The scholarship, given each year to an outstanding graduate student, recognizes original scientific research and provides $8,500 for tuition and expenses.

To identify exposure to the virus, Sreenivasan tested blood samples for influenza D antibodies. Working with the Minnesota Poultry Testing Lab, she found no evidence of the new influenza strain in poultry. However, she did find antibodies to the virus in sheep and goats from the Midwest through blood samples archived at Washington State University.

Using the bovine influenza D strain, she was the first to prove that the guinea pig could be used as an animal model to study the virus. In addition, her research showed the virus is spread only through direct contact. Those results were published in the "Journal of Virology", with Sreenivasan as the lead author.

Her current study uses the guinea pig model to compare virulence among bovine and swine influenza D strains and human influenza C.

Influenza D has about 50 percent similarity to human influenza C, Sreenivasan explains. Human C affects mostly children. She notes the most common symptom is a runny nose, and says, "It's not a serious disease. We all have some antibodies because we were infected as children."

Ultimately, the goal is to determine whether influenza D, which has 50% similarity to human influenza C, would have the potential to undergo reassortment in combination with a closely related human influenza virus and be able to form a new strain that could pose more of a threat to humans.

By Christie Delfanian

Opportunities Abound for New Livestock Unit Staff


CAMERON PEWE


JOSEPH WOLLBRINK


CASEY ZANGARO


ALEJANDRO CASELLA

THE OPENING OF BOTH the Cow-Calf and Swine Education and Research Facilities at South Dakota State University in the fall of 2016 created hands-on opportunities for both alumni and graduate students. The new facilities have recently filled new management positions.

"A key component of the new units is that they need to be properly staffed so we can ensure that we have the human resources necessary to achieve our goals," says Joe Cassady, SDSU Animal Science Department Head.

Selected as the manager of the new Swine Education and Research Facility is Cameron Pewe who began in his new role in late September. The native of Stockton, IA, is a 2013 SDSU Animal Science graduate. Pewe has experience as a wean-to-finish supervisor for Schwartz Farms and an alley buyer with Tyson Fresh Meats. He also worked on farms while pursuing his undergraduate degree.

"I never dreamed that I would come to work at SDSU, but I feel honored that they chose me because it is a great opportunity to be a part of something so new," Pewe says.

He looks forward to being in a new facility that will benefit the region and taking part in some of the nation's leading swine research.

Additionally, three graduate assistantships were created to fulfill the labor requirements that accompany the increased capabilities of the new units. To provide learning opportunities, students were specifically assigned to assistant manager roles where they have half-time labor responsibilities.

Joseph Wollbrink is working with Pewe as the assistant manager of the Swine Education and Research Facility while pursuing a graduate degree in Swine Reproductive Physiology with Jeff Clapper, Professor and Swine Reproductive Physiologist. The South Dakota Pork Producers Council funds his position in order to help train the next generation of pork industry leaders.

Hailing from Phoenix, VA, Wollbrink attended Virginia Tech where he earned a degree in Animal Science with a Pre-Vet option and emphases in beef, swine, and sheep.

"As the assistant manager, I am most looking forward to working in a farrow-to-finish barn and experiencing the different aspects of production," he says.

After earning his master's degree, Wollbrink hopes to pursue a doctorate degree at Virginia Tech or a role as manager of a research farm for Smithfield Foods.

Casey Zangaro is gaining valuable experience as the manager of the Off-site Swine Education and Research Wean-to-Finish Barn while working on her M.S. in Swine Nutrition with Tofuko Woyengo, Assistant Professor and Swine Nutritionist.

"It is a great supplement to my education to apply research in a production-like setting," Zangaro says. "I can test up to four different feed diets, eight water treatments, and I have an individual Feed Logic system that I can set up so that different pens are fed specific diets."

Originally from Fairview, KS, in the future she hopes to focus on nutrition research in a swine production company.

Alejandro Casella, a graduate student from Argentina, is the new assistant manager of the Cow-Calf Education and Research Facility. He is working on his M.S. in Ruminant Nutrition.

Casella works with Kevin Vander Wal, the facility manager, and is responsible for the Insentec electronic feeding system. Casella brings experience and knowledge from his former career with Elanco and Pfizer Animal Health.

By Sydney Sleep

Kendra Hill

"From the (SDSU) faculty community to the student community to the people of Brookings, it's a great place. At many levels you have a real sense of community."

– KENDRA HILL

SDSU History: Kendra Hill's connection to SDSU began with her father Charles (pictured with Kendra), who graduated in August 1961 with an engineering degree. However, after his service in the military, he and wife Kay left their home state for him to pursue his career in Baltimore, MD. That is where Kendra was born and raised. She completed her Bachelor's degree on the East Coast and earned a Master's from John Hopkins University. She then crossed the country to the San Francisco Bay Area working as a Production Manager for a biotechnology company. After a decade of a fast-paced, high stress career, Hill was looking for a new opportunity—and a chance to be closer to family. Her parents had retired in South Dakota, and in 2004, Hill and her husband Robert Kirby, relocated to Brookings, where she had landed a teaching position in the Department of Biology and Microbiology.

Small-Town Appeal: Hill had only ever lived in large cities, but she found herself at home in the Brookings community. She says, "From the faculty community to the student community to the people of Brookings, it's a great place. At many levels you have a real sense of community." Hill also had a unique perspective on the past, she tells, "The house we bought was catty-corner from the house where my dad had lived as a student."

Pursuing A PhD: Hill's initial role at SDSU was a non-tenure track position coordinating the Introductory Biology labs for the undergraduate program and overseeing the graduate students teaching those labs. She eventually realized that her time at SDSU also afforded her an opportunity to earn her PhD while she was working. When an initial "wet lab" research project with native grapes did not work out, Hill credits several faculty for encouraging her and working with her to devise a new project looking at how students read and learn. The metacognition and active reading study dovetailed with the biology classes and students she was working with matched Hill's passion for student learning. She earned her doctorate from SDSU in December 2013. She also co-authored a non-majors biology textbook based on her teaching and research experiences at SDSU.

Favorite SDSU Memories: Hill counts the people at SDSU as a favorite part of her experience. She says, "Everybody finds an inner circle of people who motivate, inspire, mentor and keep them sane. My list would be pretty big…an awful lot of people helped me." She also enjoyed the commitment within the Biology and Microbiology Department toward ensuring first-year success for students—through activities such as peer mentoring and bringing students and faculty together for Bum-A-Meal. "We built a community and culture around the focus on student success through several activities. It created memorable moments for everyone from students to faculty," she shares.

Teaching Others: With her PhD, Hill's interest in teaching led her to a position as a Department Chair at Portland Community College overseeing the Bioscience Technology program. Recently, she returned to industry, in the role of Production Manager for Portland, Oregon-based RevMedx, a start-up company dedicated to saving lives by creating groundbreaking medical products designed specifically for combat medics and civilian first responders. Hill shares that she is still using the teaching experience she gained at SDSU. "My role is to make sure people are properly trained and follow procedures—just as I did with students—and that they have a sense of teamwork and accomplishment."

Reflective Perspective: Looking back on her time at SDSU, Hill says she values the critical thinking and problem solving skills gained while earning her PhD. She says, "It's a rite of passage and sometimes requires navigating stormy waters. It does teach perseverance and learning to communicate in a variety of ways to accomplish an important task." Additionally, in her role as lab coordinator, Hill says she gained important perspective on the process of teaching and learning. "You must discover how to teach so students learn; and the interaction with the students provides so much opportunity to learn from them and think about things differently." Today, in her role with RevMedx she notes, "Much of what I do as a Production Manager can be a teaching moment. I don't think I had that understanding before I went to SDSU."

By Kindra Gordon

Why We Give...

I'VE BEEN BLESSED to have my position with the Foundation now for five years. My work has provided me with a great opportunity to learn about how people give and when they give, but what has moved me the most is ***why*** they give.

As I have mentioned in previous columns, giving is very personal and, let's face it, can be very difficult. So why do some people do it, when others don't? I have good friends who could give and choose not to. I also have good friends who don't have much to give, but somehow make it a priority to be charitable. I am so far away from having a psychology degree that it isn't even worth discussing, but the ***why*** intrigues me. The question is worthy of research, which I assume is taking place somewhere.

I've had the opportunity to sit across the table when people make some of these decisions and I often ask them why they give. The list of answers is long and varied, but there is one word that is a consistent part of their answers – gratitude. Gratitude for the opportunity to get an education that allowed them to have a successful career, gratitude for a teacher or a professor who acknowledged their existence and believed in them, gratitude for parents who raised them with love and purpose, the list goes on.

So, after five years of getting to know so many of you and being inspired by each of you, I am grateful. Thank you for your willingness to reflect on your blessings and to support SDSU, and other worthy places and people, as a tangible way to express your gratitude.

MIKE BARBER '97

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Research®
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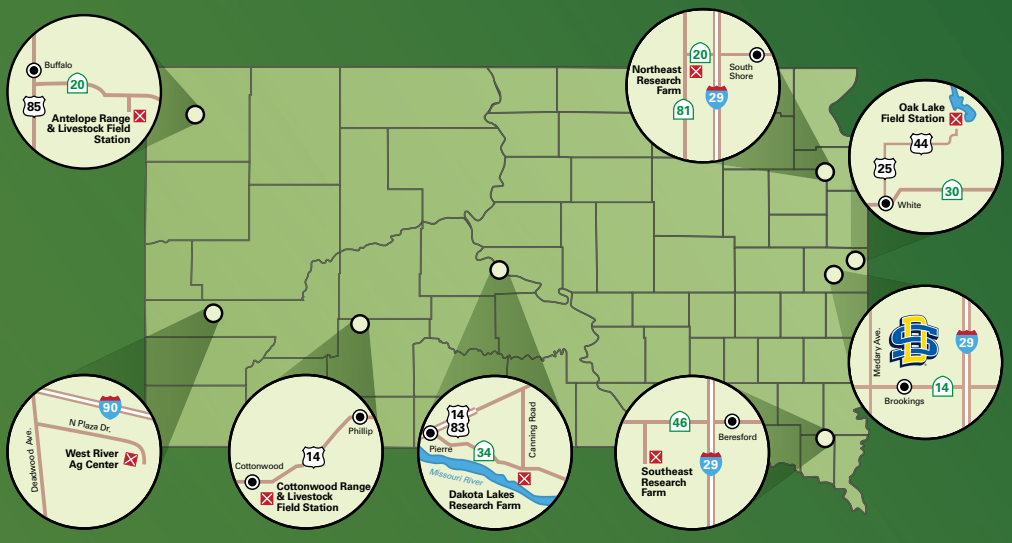
South Dakota State University researchers conduct ongoing studies in real-life settings at field stations operated by the South Dakota Agricultural Experiment Station across the state. The unique locations of each of these research facilities allow for diverse research that is responsive to the needs of the farms and ranches, businesses and lives of South Dakotans.



Plan to join SDSU faculty and staff for field days and events at these locations in 2017.
Watch http://www.iGrow.org for future event information.