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Strategic Discussions for Nebraska

Nebraska: The Epicenter of Global Beef Production

Welcome to IANR's newly designed issue of Strategic Discussions for Nebraska.

This interactive pdf contains lots of additional information so please interact and click on the **red text**, VIDEO or SDN EXPANDED buttons whenever you see them.

IANR

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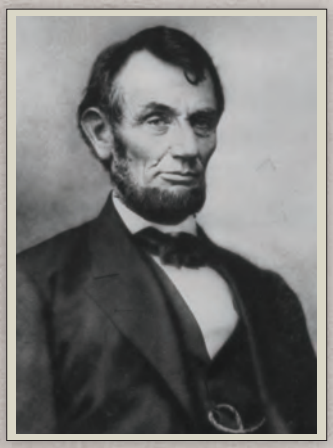
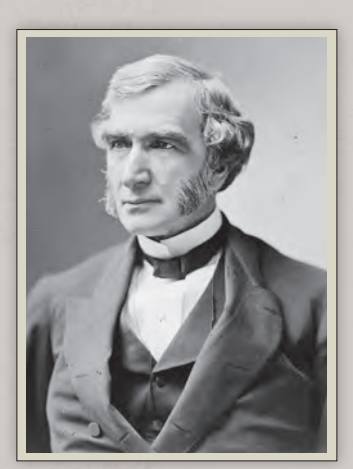
THE MORRILL ACT OF 1862

On July 2, 1862, President Abraham Lincoln signed into law a bill that donated land to each state for the establishment of colleges to provide a liberal and practical education to the "industrial class," or the common person. These colleges would provide instruction in agriculture and the mechanic arts, such as engineering. Because of the land granted to each state and territory, the Morrill Act of 1862 became known as the land-grant act.

Sponsored by U.S. Congressman Justin Smith Morrill of Vermont, the bill allotted 30,000 acres of public land for each sitting senator and representative in Congress to establish these colleges. Morrill could not have known the future impact this law would have in providing equal opportunity to education in the United States and its territories.

Today, there are more than 100 land-grant institutions in the United States and its territories, each focusing on teaching, research and outreach — taking new knowledge to the people.





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STRATEGIC DISCUSSIONS FOR NEBRASKA

Strategic Discussions for Nebraska is a program that presents University of Nebraska research so a general audience can understand its importance. Students enrolled in a UNL Magazine Writing course in the Department of Agricultural Leadership, Education and Communication produce much of the content for this publication. I teach this course, which allows students to learn to conduct interviews and write stories based on the interviews. They learn about the importance of detail and accuracy in these science-related topics, as well as how to communicate complex information so it can be easily understood and its importance communicated.

The UNL Institute of Agriculture and Natural Resources Educational Media unit provided videography, video editing, graphic design, photography, website, business and liaison services for the production of this publication.

As coordinator of Strategic Discussions for Nebraska, I express sincere appreciation for the vision and financial support of the Robert and Ardis James Family Foundation, which founded Strategic Discussions for Nebraska in 2007.

Strategic Discussions for Nebraska now is funded by, and housed in the University of Nebraska–Lincoln Institute of Agriculture and Natural Resources (IANR), in the College of Agricultural Sciences and Natural Resources' Department of Agricultural Leadership, Education and Communication. Please visit our website: *sdn.unl.edu*

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NEBRASKA: GLOBAL BEEF INDUSTRY LEADER

Ronnie Green
University of Nebraska
Vice President

and Harlan Vice Chancellor, Institute of Agriculture and Natural Resources

SDN EXPANDED

As the Nation's top red meat producing state, Nebraska is the beef epicenter of the United States and a global beef industry leader.

First in red meat production, first in commercial cattle harvest, second in cattle and calves, second in cattle on feed – there's good reason we're known as the Beef State.

Recently in the Institute of Agriculture and Natural Resources we took an in-depth look at how the Institute can best help Nebraska grow a healthy future. In a state where agriculture is the leading industry, and Nebraska's farms and ranches cover 93 percent of the state's total land area, it is both our privilege and responsibility to do so.

We determined that the red meat industry, with the tremendous demand an ever-increasing world population places upon it, is certainly a healthy future growth area for Nebraska. As incomes increase in developing countries, so does demand for the tasty, excellent protein source that is beef.

Our state is known for the excellence of Nebraska beef, and the excellence of those who work in beef research, teaching and extension at your land-grant university. This issue of *Strategic Discussions* reflects that excellence in such areas as beef research, environmental sustainability, health, safety, care and well-being of animals and people, and student learning.

Research, teaching and extension are the three intertwined missions of your land-grant university. We take each very seriously, as witnessed by the commitment and expertise our faculty and staff bring to them.

All three are priorities, contributing to the education of today's students, who are tomorrow's industry leaders.

Those leaders must be good stewards of the natural and animal resources entrusted to them, and good decision makers regarding those resources. That affects the sustainability and food production needed to feed a hungry world, which affects us all.

IANR currently has a rare opportunity to strategically invest in 36 new positions to benefit our students and all of Nebraska. Some of those positions will bolster our already strong work in beef, providing great dividends for Nebraska's and the world's healthy future.

New people will bring expertise ranging from identifying and characterizing networks of genes with significant impact on economically relevant cattle traits, to ways to produce more good-tasting, healthy beef while using fewer resources and maintaining and enhancing excellent stewardship. They'll bring knowledge to better understand how animals respond to their environment, including to encounters with disease, and much more.

Genetics and genomics are IANR strengths. Partnering with scientists at the U.S. Meat Animal Research Center in Clay Center, we believe Nebraska can and should be the world leader in this area. New hires will build on strengths already here.

It is a point of pride with us that one of the things IANR does exceptionally well is connect basic research to constituents so Nebraskans can quickly gain and put new knowledge to work in their businesses and lives.

A thriving, innovative beef industry is a definite part of growing a healthy future for Nebraska and the world, and we are dedicated to that growth.

CREATIVE SOLUTIONS ESSENTIAL TO THE FUTURE

Larry Berger
Head
University of Nebraska—Lincoln
Department of Animal Science

The University of Nebraska–Lincoln Department of Animal Science is committed to helping Nebraska become the epicenter of the beef industry through its teaching, research and extension missions.

Preparing students for the future is our top priority. Tomorrow's leaders in the beef industry will need a wide range of skills to find creative solutions to issues that will be more complex than ever before.

Experiential learning and effective communication skills are essential for future leaders and are being taught both inside and outside the classroom. For example, the meats and livestock judging teams provide experiential learning. Communication skills are enhanced through participation in the Block and Bridle Club and Beef Industry Scholars program. The Beef Industry Scholars program combines the knowledge and insights and direct involvement of leaders in the beef industry with science-based courses led by nationally recognized faculty. Another experiential learning opportunity is available through the Feedlot Internship program. This is a nationally-recognized feedyard management training program, exclusive to UNL, which has been training future feedyard managers and industry leaders since 1989.

We are committed to using a systems approach to evaluate the impact of new technology from conception to consumption. A perfect example of why this approach is needed is the fetal programming research. This research shows that proper nutrient supplementation of the cow during critical stages of gestation can influence the productivity of that fetus for the rest of its life. Never have the opportunities been greater, or the need more immediate to use science to address food safety, greenhouse gas production, feed efficiency, water requirements, improving feed resource utilization and a host of other issues facing the beef industry.

The Institute of Agriculture and Natural Resources, under Vice Chancellor Ronnie Green's leadership, is taking bold steps to hire the talent that will bring science to bear on the issues facing beef industry. For example, a team of faculty with backgrounds in agronomy, agricultural economics, veterinary medicine and animal science will be addressing the issue of how to optimize corn residue utilization. Another example is where a team with expertise in molecular biology, bioinformatics, microbial ecology, ruminant nutrition, meat science and food safety are evaluating novel methods to reduce *E. coli* O157:H7. Confinement feeding of beef cows is also being evaluated using a multi-disciplinary, multi-institutional approach.

The extension component of the UNL Department of Animal Science is committed to developing creative, effective delivery methods of getting information to end users. For example, the department has teamed up with the Nebraska Cattlemen and the Nebraska Beef Council to develop a nationally-recognized Beef Quality Assurance (BQA) program. We will optimize how information is disseminated through a combination of face-to-face meetings, printed materials, webinars, YouTube videos, mobile apps and more, to allow producers to have flexibility in how they obtain information.

The UNL Department of Animal Science is committed to developing the human capital, science-based information and technology transfer systems that will help Nebraska become the epicenter of the beef industry.

NEBRASKA BEEF:

nutritious
delicious
sustainable

There is a continuing increase in the percentage of the global population that is coming out of poverty into middle class. Estimates indicate that over the next three decades, there will be three billion more people in the world — three billion more who will want animal protein who don't consume animal protein today.

We are educating the next generation of students to be able to develop and apply innovation for the future that will make the beef industry sustainable and to be able to meet that global demand for beef.

Today's students will lead our future.

Ronnie Green
University of Nebraska Vice President for Agriculture and Natural Resources
Harlan Vice Chancellor, University of Nebraska–Lincoln
Institute of Agriculture and Natural Resources

INCREASED DEMAND FOR NEBRASKA BEEF
will require more innovation

by Stephanie Smolek

VIDEO

Nebraska's diverse land resources, the people's devotion to agriculture and the access to water resources in the state make Nebraska ideal for agricultural production, specifically beef cattle production, Green said.

IN 2050, nearly 3 billion more people in the world will want animal protein in their diets, said Ronnie Green, Harlan Vice Chancellor for the University of Nebraska–Lincoln Institute of Agriculture and Natural Resources and University of Nebraska Vice President.

The world population is estimated to increase to more than 9 billion people by 2050, Green said. Additionally, as the economies in places like China, sub-Saharan Africa and Brazil continue to grow, more people will come out of poverty and into the middle class, he added.

"There's a growing demand for beef in many of those markets," Green said.

The University of Nebraska–Lincoln will be the center of beef cattle innovation as this demand increases, according to Green.

The world will have to produce more food with fewer resources, Green said, so beef will have to be raised using less water and fewer feed inputs.

"We're going to have to continue to innovate, maybe more than we've seen happen in our lifetimes in the field," Green said.

NEBRASKA'S ROLE

Maintaining natural resources will continue to be important as the beef industry grows, according to Green. Producers in Nebraska will continue to preserve, sustain and grow resources in the state, like water, land, soil and air, he said.

"We're the stewards of that resource," Green said.

"The highest quality beef produced in the U.S. is produced in this region because of the climate we have and those resources that we have," he added.

The agriculture industry is the largest industry in the state. In 2011, the agriculture industry contributed over $21 billion to Nebraska's economy, according to the Nebraska Department of Agriculture. The beef cattle industry makes the largest impact on that dollar amount, Green said.

Nebraska ranks high in cattle production when compared to other states in the U.S., he added. According to the Nebraska Department of Agriculture, these rankings are as follows:

- First in commercial red meat production
- First in commercial cattle harvest
- Second in the largest total number of cattle and calves
- Second in the largest number of cattle on feed
- Second in beef exports

The U.S. is the leading beef-producing country in the world, Green said. As a leading beef producing state, Nebraska is a global leader in the industry, he added.

The state is also is home to the U.S. Meat Animal Research Center in Clay Center, Neb., where U.S. Department of Agriculture researchers and UNL researchers work alongside each other in beef cattle research.

UNL'S ROLE

The University of Nebraska–Lincoln has a strong history of supporting the beef industry, Green said; it's known worldwide as a leader in beef cattle of nutrition, breeding, genetics and efficiency.

Professors at UNL pioneered the understanding of how to feed grain to cattle in a feedlot setting to obtain high efficiency and a high-quality, flavorful product that is desired around the world, Green said.

That work has affected the cattle feeding industry not only in the U.S. but also in Australia, New Zealand, Brazil and Argentina, he added.

"Those are the leading beef industries in the world now, as a result of taking that technology and applying it and using it," Green said.

Research conducted at UNL, even though it is designed to be used in Nebraska, is applicable around the world. The genetic improvement systems that are used around the world were also created at UNL, according to Green.

> ***"We're educating*** *the next generation of students to be able to use and apply all these innovations," he said, "that will make this industry sustainable and able to meet the demand."*
>
> *— Ronnie Green*

In 2012, Nebraska experienced a severe drought that put the university's drought research to the test. The research was proven to be successful, Green said.

"You can't be a successful cow-calf rancher in the Sandhills unless you are applying very sound range management principles that the university has worked on for decades," he said.

The use of coproducts from the ethanol industry in beef cattle feeding is another example of the university's research success, Green said.

Mandates for renewable fuels increased about 10 years ago, sparking growth in the ethanol industry. Corn that used to be fed to cattle went to ethanol plants, increasing the cost of corn, Green said.

Cattle producers wanted to find a lower-cost feed resource that could replace some of the corn in cattle diets. So, researchers at UNL looked for an answer, Green said.

Their research efforts determined that distillers grains, a coproduct of the ethanol industry, could be that replacement, he added.

The use of distillers grains is part of the reason the cattle industry in the U.S. is shifting to Nebraska and area states, Green said. Nebraska has the resources needed to produce ethanol and its co-products, he explained.

In 2012, Nebraska was recorded to have the largest ethanol production capacity in the U.S., according to the Nebraska Department of Agriculture.

EDUCATING STUDENTS, CREATING INNOVATIONS

Green's top priority for the UNL Institute of Agriculture and Natural Resources is continuing to provide a comprehensive, interdisciplinary education for students. These students, he said, will be industry leaders and stewards of the natural resources that the beef industry will use into the future.

"We're educating the next generation of students to be able to use and apply all these innovations," he said, "that will make this industry sustainable and able to meet the demand."

It is important to ensure that Nebraska is using its resources to make the most difference for the most people in the state, he said.

Green believes that UNL and Nebraska will continue to have a larger presence in the beef industry.

The growing season in Nebraska is becoming longer, and Nebraska has a strong cow-calf sector, necessary water resources, and the land needed to allow for the highest quality of beef to be produced.

However, in order to meet the growing demand for beef while reducing the use of these resources, such as water, innovation is required, Green said.

"It's going to require us to work in teams of people like we've never worked before," he said.

Researchers will have to work in interdisciplinary groups to innovate beef production, using the rapidly advancing technology available, according to Green.

"If we're going to figure out how to use less water ... we're not going to do that as individual people. We're going to take the whole continuum of people working together," he said.

OUTREACH

Research discoveries do not have an effect, though, unless the beef cattle industry understands and implements that research into their cattle production systems, Green said.

Researchers at UNL continually publish the results of their work in scientific journals around the world, such as the Journal of Animal Science. However, the discoveries still have to be translated so people in the general public, locally and globally, understand them, Green said.

The UNL Extension service helps in this process. "The whole idea of extension is to translate it (research) into use," Green said.

Many professors at UNL have research, extension and education appointments, or a combination of the three. This ensures that discoveries are made, translated and put into practice, Green said.

FUNDING

Beef cattle research, extension and education at the Institute of Agriculture and Natural Resources at UNL are funded through multiple sources.

The state of Nebraska sets aside money from tax dollars for the Institute of Agricultural and Natural Resources. This constitutes a little less than half of the institute's operating budget, Green said.

A small part of the institute's budget is funded by the federal government, he added.

Grants and contracts — from the beef industry, the federal government and foundations — that support research make up another large share of the budget, he said.

The University of Nebraska Foundation supports scholarships for students, faculty funding and graduate student funding. Revolving funds, which are raised from the profit the university's research farms and ranches generate, complete the institute's budget.

"IN THE BIG TEN, we have major land-grant universities who are really focused on commercial agriculture. We're developing new partnerships with those universities that are paying dividends right here in Nebraska," said Chuck Hibberd, who became Dean of Extension at the University of Nebraska–Lincoln in November of 2012.

The other thing that's really exciting right now in Nebraska, and especially in the UNL Institute of Agriculture and Natural Resources (IANR), is the bold vision of the IANR vice chancellor, Ronnie Green, and his big ideas of what Nebraska can be, Hibberd said.

And UNL Extension is in the middle of it all.

"We're committed to making a difference in Nebraska," Hibberd said, "by providing research-based information that helps people accomplish the kinds of things they want to accomplish."

The Morrill Act of 1862 established land-grant institutions that made higher education accessible to everyone, not just to the wealthy, These land-grant institutions were established to provide specific education in agriculture and the mechanic arts. In 1887, the Hatch Act established research farms for the land-grant institutions; and in 1914, the Smith-Lever Act established the Cooperative Extension Service, providing a way to take the research findings to the people.

Today, UNL Extension is the largest informal education program in Nebraska, facilitated by UNL Extension educators in 83 of Nebraska's 93 counties. Extension provides unbiased, research-based information to Nebraskans, whether they are agricultural producers, entrepreneurs, home gardeners or 4-H youth.

"It is really exciting to be a part of a time in Nebraska where things are growing and changing, and especially the Institute of Agriculture and Natural Resources. We truly want to be the epicenter of agriculture in the U.S. and we're well on our way to getting there," Hibberd said.

HIBBERD'S VISION FOR EXTENSION

"In extension, we transform research-based information into products that anybody can use," Hibberd said. He said there are three key elements for extension's success:

Being relevant. Extension educators need to understand what challenges Nebraskans face, and allocate research funding to find solutions to those challenges.

Providing research-based information. There is adequate research being conducted across the state and UNL Extension takes that information to agricultural producers.

Using appropriate methods to communicate information. Consumers use technology to get their information, and having information available on the Internet is one of the best ways to reach people.

"Those are three of the really important things about extension, and if we do those three things really well there will be a lot of people, I think, who will say, 'We couldn't have done it without UNL Extension. It is a key part of our success.' And that's where we want to be," Hibberd said.

This year, there will be more than 75 on-farm research trials to test research that was discovered in a laboratory or on a small plot. The goal is to see if it works in a real-world setting, Hibberd said. Making research applicable to the people who can best use it is "a key part of the research we're doing," he added.

GLOBAL VISION, GLOBAL BEHAVIOR

Prior to becoming dean of UNL Extension in 2012, Hibberd was dean of extension at Purdue University. Before that, he was director of the UNL Panhandle Research and Extension Center in Scottsbluff, from 1994 to 2007. It was there, he said, that he discovered the importance of extension education.

"We place experts who do research and extension work right in the middle of the production region, so that they can work under the environmental circumstances with the producers to help them improve their agricultural operations," Hibberd said. "I was able to live and work right in the middle of that environment where agriculture was really big and really important. It was a very exciting time for me."

While at the Panhandle Research and Extension Center, Hibberd had the opportunity to share agricultural data with agricultural professors from Bamiyan University in Afghanistan, who came to western Nebraska to learn methods used to grow crops. Afghanistan has an ecosystem that is similar to that of western Nebraska.

"They went back to Afghanistan, and they took with them some wheat varieties developed by (UNL wheat breeder) Dr. Steve Baenziger. They planted those wheat varieties there. We planted those wheat varieties at the Panhandle. We compared notes, and not only were we learning about what kinds of wheat grow well in Bamiyan, Afghanistan, but we were also teaching them how to do applied research,"

EXTENSION:
'we're making a difference in Nebraska'

VIDEO

by Levi McPhillips

Nebraska's move to the Big Ten in 2011 was about more than athletics.

Hibberd explained. The program partnership with Bamiyan University was exciting, Hibberd said, because the professors learned to do applied research and took those skills back to the Afghan people, who could then grow more and higher-quality food to feed their people.

Hibberd went with Nebraska Governor Dave Heineman on the first agricultural trade mission to Cuba in 2005, during which Cuba established a $17 million contract to buy dry edible beans from western Nebraska.

"That really lit my fire in terms of the way extension could be involved in international work, and really extend our knowledge and expertise beyond the borders of the state of Nebraska," he said.

Hibberd wants extension educators to continue to further the international reach of UNL. He wants UNL Extension professionals to work in other countries for a few weeks, and says he believes extension educators will return with valuable knowledge and experiences.

"When those extension professionals come back, they have two things that are really important. One is an understanding of how to work in another country, in another setting, and appreciation for what it's like to work with other people. And the other thing is they bring those experiences back to Nebraska and back to their hometown," Hibberd said.

"And," he said, "they can help people in Nebraska understand that we live and work in a global setting and if we don't understand that and we don't behave that way, we're not going to be successful going forward."

PROGRAMS MAKING A DIFFERENCE

The Ranch Practicum is one extension program developed for Nebraska's cattle producers. Ranchers, as well as officials from Nebraska Game and Parks and Nebraska Resource Conservation Service (NRCS) learn about advances in cattle production that have been developed by UNL research, Hibberd explained.

"They (ranchers) get both classroom and hands-on experience in all aspects of ranching and ranch production. And in that process they learn about how to monitor the forage in pastures, how to decide when to take cows off pasture, how to monitor for weeds, how to take care of cows during calving and during the breeding season. This is impacting ranchers in Nebraska in a very real way in terms of how they produce cattle," Hibberd said.

Another program offered by UNL Extension is the 4-H Quality Assurance Program. This online course helps young people involved in 4-H learn practices to properly raise animals. In addition, the program teaches what needs to be done to ensure that the meat from those animals is safe to eat. The curriculum includes techniques for handling animals, giving medications to livestock, and how to prepare animals for harvest.

"The best part is when people take this program online they actually have to take a quiz, so we know whether or not they are understanding and learning the information that we provide," Hibberd said.

Hibberd and UNL Extension educators pay close attention to metrics that show the information has impact.

"It's not enough to just throw things out there and see what people may or may not want to use. We have to be able to demonstrate that our work makes a difference. And that difference is what we call impact. If we're not able to achieve impact, then the people that decide how to fund the University of Nebraska are going to choose perhaps to invest their dollars in other ways. And so it's really important for us to be able to demonstrate the value of the work that we do," Hibberd said.

EXTENSION'S WORK WITH DROUGHT

The drought of 2012 brought new challenges to livestock producers and Extension educators. However, that was not the first time UNL Extension has helped Nebraskans deal with a drought. While at the Panhandle Research and Extension Center, Hibberd said, "we had an extended drought from 2003 to 2007. And we worked closely with the sugar beet farmers who typically would apply 22-24 inches of irrigation, and during that time they had only 15 inches of irrigation water to put on. They were able to do that and still produce 90 percent of a normal crop."

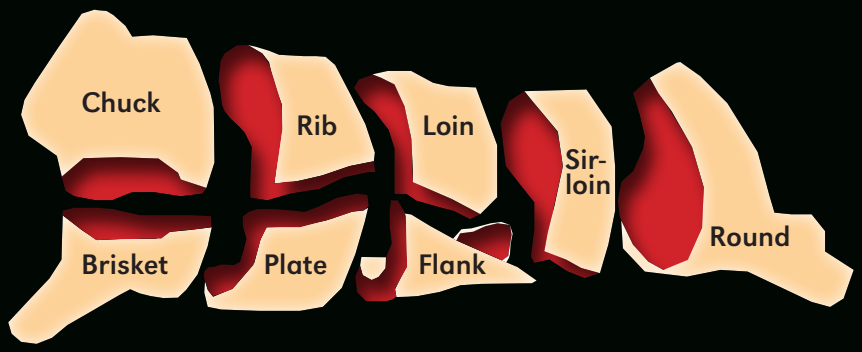
"My approach especially as we get deep into these kinds of real disasters that affect a lot of people is to have an 'all hands on deck' approach," Hibberd said. "And so that's what we try to do is help our folks mobilize and respond to things like the drought."

For more information about University of Nebraska–Lincoln Extension, or to find an extension educator near you, go to *extension.unl.edu*

let's talk beef

The Beef Promotion and Operating Committee in the 1990s responded to depressed prices for the beef round and chuck cuts of meat using a series of related Beef Checkoff-funded projects. A scientific process to analyze individual muscles in the chuck and round identified cuts with marketable value beyond their traditional use. New value-added beef cuts were developed to meet consumer needs, both in retail and food service.

VALUE-ADDED CUTS IN THE CHUCK AND ROUND



CHUCK CUTS

Chuck Roll– Sierra Cut, Denver Cut, America's Beef Roast, Boneless Country-Style Ribs, Delmonico Steak

Chuck Shoulder Cold– Flat Iron Steak, Ranch Steak, Shoulder Petite Tender

ROUND CUTS

Top Inside Round– San Antonio Steak, Round Petite Tender, Tucson Cut, Santa Fe Cut

Heel– Braison Cut, Merlot Cut

Bottom (Outside) Round– Western Griller, Western Tip Steak

TOP GRILLING SELECTIONS

1. Beef Ribeye
2. Beef Loin Top Sirloin
3. Beef Top Loin Sirloin
4. Beef Loin T-Bone
5. Beef Ribeye Bone In
6. Beef Top Loin Bone In
7. Beef Porterhouse Bone In
8. Beef Filet Mignon
9. Beef Loin Tri Tip Roast
10. Beef Delmonico Steak

tracking beef

25.6 billion pounds of beef consumed in the U.S. in 2011

45.2 billion dollars: value of cattle and calf production in the U.S. in 2011

79 billion retail dollars spent on beef in the U.S. in 2011

26.29 billion pounds of commercial carcass weight in the U.S. in 2011

flat iron steak

Traditional methods of meat-cutting meant that the top blade roast from the shoulder of the beef animal was used for roasts or hamburger. Challenging those traditional methods led UNL meat scientist, Chris Calkins (pictured), and colleagues from the University of Florida to identify the Flat Iron steak in that roast. Research funding was provided by the Beef Checkoff.

An average of 90 million pounds of Flat Iron steaks are sold in restaurants every year. That cut of meat, along with other cuts identified by the research, has added between $50 and $70 in value to every beef animal harvested in the U.S., for a total of $1.5 billion annually. Since Nebraska produces more than 20 percent of the beef in the U.S., the project which produced the Flat Iron steak has added $1.5 billion to Nebraska's economy over a five-year period.

The Flat Iron steak is tender, with a deep, rich flavor and is perfect for the grill. It is best grilled over a medium-high heat.

NOT ONLY THAT, but research has shown that young children who are fed beef as one of their first foods have increased cognitive development, according to the executive director of the Nebraska Beef Council, Ann Marie Bosshamer. Bosshamer is a global proponent of beef from Nebraska, a cattle rancher and a mother who regularly enjoys beef with her family.

"It's the most nutrient-dense protein available," she said.

Nutrition research is just one bite of information she shares when she talks about beef to international audiences.

"Probably the number one thing we try to convey in a global market is that farmers and ranchers of Nebraska and across the United States take care of their animals so very well," Bosshamer said.

"Farmers and ranchers also are environmental stewards; they're great caretakers of the land and the animals. We make such great efforts, 24 hours a day, seven days a week to care for those cattle to make sure they are healthy animals that provide healthy beef," she said.

It's the taste of beef that keeps consumers coming back for more.

"You don't have to do a lot to it to get a lot of flavor," Bosshamer said. "Here in Nebraska, the majority of our beef is corn-fed, so the marbling that results creates a wonderful eating experience."

Bosshamer works with farmers, ranchers, meatpacking businesses, chefs, retailers, distributors and nutritionists — all the way to the consumer.

"I get to see all segments of the industry and how they are linked together," she said, "and I am able to promote what I think is the best beef in the world."

The Nebraska Beef Council is funded through the Beef Checkoff Program, which was established as part of the 1985 Farm Bill. The checkoff assesses $1 per animal; half of that amount is used for in-state beef promotion, education and research; the other half is forwarded to the Cattlemen's Beef Promotion and Research Board for the same purposes. Bosshamer's job is to oversee the collection of the checkoff

NEBRASKA BEEF COUNCIL

supports research, education and promotion

by Mary Garbacz

VIDEO

Beef has ZIP *— zinc, iron and protein — and 10 essential vitamins and nutrients that the human body needs.*

Nebraska Beef Council

in Nebraska, work with the Board of Directors to invest the dollars appropriately and be a spokesperson for beef from Nebraska.

FOREIGN MARKETING

The Nebraska Beef Council markets beef from Nebraska around the world through the U.S. Meat Export Federation and through the Nebraska Department of Agriculture, facilitating promotions and education programs.

"Foreign marketing efforts are always an important mainstay of what we do," she said. "We really appreciate our global consumer and recognize that the product we raise here in Nebraska is something they want."

The Nebraska Beef Council's work with the Nebraska Department of Agriculture has resulted in projects such as educational programs at a Hong Kong culinary school to teach chefs about beef cuts and cooking methods, as well as attendance at food shows in Singapore and in other countries to showcase the quality and taste of beef from Nebraska.

The council's work with the Nebraska Department of Agriculture also has resulted in visits to Nebraska by the Hong Kong chefs and by others who want to see how beef from Nebraska is raised and why it results in a particularly high-quality product. For instance, a high-end restaurant chain in London that features Nebraska beef on its menus brings a management team to Nebraska every year. The group tours the state, learning about beef production, eating beef at Nebraska ranchers' tables and visiting the University of Nebraska–Lincoln to learn about the nutrition, management and meat science research that helps produce the state's high-quality beef.

"We continue to keep foreign marketing as a very high priority for beef checkoff programs in Nebraska," she said. The Nebraska Beef Council also looks for new opportunities globally; an emerging market is in Central America, she added.

Bosshamer said the Asian market has always been a positive market for beef from Nebraska and she attributes that to two main reasons.

"They recognize that we have the resources here in Nebraska to have very high-quality grain-fed beef, and they know the packing plants here in Nebraska — and their plant numbers — so they respect that quality they are getting.

"But I also think there is a true love for that cowboy, who they think of when they think of Nebraska," she said. Nebraska cattle producers frequently travel to other countries so prospective beef buyers can meet the people who actually care for the land and animals that result in the high-quality beef product they enjoy, she added.

Bosshamer said Nebraska's farmers and ranchers appreciate both domestic and foreign markets, but the foreign markets present a unique opportunity.

"Everyone loves steaks and roasts and ground beef, but we also recognize that there's a lot of the rest of the carcass that does need to be used and those foreign markets want to purchase the parts of the carcass that aren't used domestically," Bosshamer said. Nebraska farmers and ranchers understand the importance of that foreign market and the need to continue global marketing programs, she added.

NEBRASKA'S RESOURCES

Nebraska is blessed with natural resources, Bosshamer said, including the rich soils in the eastern part of the state, the sandy soils in western Nebraska, climate and water resources.

"We have everything here to raise a great-quality product," she added.

Much of the state overlies the High Plains Aquifer, also known as the Ogallala Aquifer. The aquifer provides groundwater and surface water for irrigation of crops and water for animals.

Even with the wealth of aquifer water, Nebraska relies on rain for the crops and grasses that feed cattle in the Sandhills region of the state. A widespread drought in 2012 had cattle producers looking to other opportunities and technologies to continue to grow the amount of beef that Nebraska needs to grow, Bosshamer explained.

FEEDING THE WORLD

By 2050, estimates indicate that the three billion more people on Earth will require 100 percent more food, due not only to increasing numbers, but also to increasing affluence. Farmers and ranchers have used technologies over the years to help them become more efficient as they raise cattle, Bosshamer said.

"That is something that is going to be very important as we look to a growing population around the world," she said. "We do a great job in terms of using feeding technologies, becoming very efficient in keeping the pounds available that the world requires."

EFFICIENCY DRIVES beef systems research

by Stephanie Smolek

VIDEO

Every day, University of Nebraska–Lincoln experts explore opportunities to enhance beef production in a sustainable and responsible way. The goal is to help beef producers in Nebraska, said Rick Rasby, professor of animal science and UNL Extension beef specialist.

"WE WANT TO PRODUCE not only a safe product in this industry, but we also want to produce a highly nutritious product," Rasby said. "It really relates back to how we're going to feed the nation and how we're going to feed the world."

Systems guide the beef industry in Nebraska, from the birth of a calf to a fully grown animal. Research at UNL is aimed at helping cattle producers "tweak their systems to increase their production efficiency," Rasby said.

For 27 years, Rasby has been a part of this development at UNL. Although he spends 25 percent of his time working on this research, most of Rasby's time is spent in extension.

As an extension specialist, Rasby repackages the university's research discoveries so producers can understand, implement and benefit from the information.

COW-CALF OPERATIONS — THE BASE OF THE BEEF INDUSTRY

Rasby's research and extension career has focused on the cow-calf segment of the beef industry.

"I work with cow-calf producers anywhere," Rasby said. "Folks that have 50 head of cows up to folks that have 1,000 head of cows and more."

In this part of the beef system, producers care for mature cows and newborn calves throughout the cows' pregnancies, the birthing process and during the first segment of the calves' lives. This is the base of the beef industry, Rasby said.

When it comes time to separate the calves from their mothers, a cow-calf producer may sell the calves or retain ownership of them throughout the rest of the production phase, Rasby added.

DECISIONS AFFECT BEEF PRODUCTS

According to Rasby, cow-calf producers have to consider how their decisions affect the end product, a protein source for consumers. Systems research, he added, looks at how an end product, such as beef protein, is produced. It analyzes every decision and input that goes into producing that product, Rasby said.

Specifically, Rasby's systems research evaluates how producers' cow management decisions, calving time decisions and weaning time decisions affect beef products. Rasby shares his discoveries with producers so they can use the research to improve production and economic efficiency at their cow-calf operations.

With more efficiency, there is more opportunity to increase profit potential, Rasby said.

Rasby also considers how different management decisions and inputs can lead to the same end product.

For example, he and other systems researchers at UNL evaluate feeds that could be used as alternative feed sources in cattle production, such as distillers grains. Distillers grains are a coproduct of the ethanol industry that have changed feeding in cattle operations, Rasby said.

He and other animal science specialists at UNL have researched, evaluated and shown producers how distillers grains can be used as a feed resource to increase efficiency in all sections of cattle production.

"It's really been good for Nebraska," he said. "It's a feed resource that really fits extremely well, not only in the feedlot side of things, but also on the cow-calf side of things."

Justin McPhillips of J & K Farms bottle-feeds a newborn calf

MULTIDISCIPLINARY RESEARCH INVOLVES FACULTY, STUDENTS

In addition to the faculty in the animal science department, beef systems research involves professionals in agricultural economics and agronomy, Rasby said. Graduate students also are involved in the research, he added.

"Part of our responsibility here is to develop graduate students," Rasby said. Faculty at UNL train and help develop students that influence Nebraska, the United States and the world, he added.

Putting these great minds together will help UNL's faculty continue to receive funding for their research, despite tight budgets, Rasby said.

DROUGHT CHALLENGES CURRENT PRACTICES

The drought of 2012 in Nebraska and much of the United States affected Rasby's research and extension work.

Feed input costs increased because limited water availability stunted the growth of many feed plants, Rasby said. Traditional feed resources became scarce, he added.

During the drought, he communicated with cattle producers about university research that focused on methods to increase feed efficiency, as well as increase the use of alternative feeds, such as distillers grains.

To further conserve feed resources, Nebraska producers sold more beef cows in 2012 than they would in a normal year, Rasby said. If beef cow numbers continue to decrease because of these cattle sales and feed costs continue to rise, the price for beef products will increase, Rasby said.

This will present a challenge for consumers as well as producers, he added.

"They (consumers) only have so much money to spend on protein products, and we want them to buy beef," Rasby said.

PROBLEM SOLVING CONTINUES AT UNL

Despite this challenge, Rasby said, UNL still has the animal resources to continue research programs that will help beef producers in Nebraska and beyond. Unlike many universities, UNL has been able to maintain its cow-calf herds, as well as its feedlot units, he added.

Research funding — some of which has come from commodity boards — helped keep these resources together, Rasby said. UNL professors have continued to receive these grants, in part because of Nebraska's geographical diversity.

Beef cattle production practices in Nebraska differ significantly because of vastly different soils, elevation and rainfall in the state, Rasby said. Therefore, UNL is doing research that will be beneficial in each of Nebraska's geographical locations, he added.

According to Rasby, the discoveries made by UNL researchers not only will be beneficial in Nebraska, but also in other areas of the U.S. and world where conditions are similar.

Likewise, export markets have opened up, allowing UNL research and Nebraska the opportunity to provide beef and other food products to not only people in the U.S. but also people around the world, Rasby said.

With each new discovery, it becomes more challenging to reach the next level of efficiency, Rasby said. But research continues to determine how the new knowledge can influence global cattle production and the high-quality protein the animals provide to the world.

"What we do really well is we produce beef cattle," Rasby said. "We do it very efficiently. We do it the best way that we can in regards to how we might manage our resources so that they're sustainable over a long period of time."

BEEF bites

- A cow gives birth to her first calf at 2 years.
- The cow is pregnant for 9 months average = 283 days, ranging from 272-291 days.
- To calculate when a cow will give birth, add 7 days and subtract 3 months from her most recent mating date.
- The cow weighs around 1,200 pounds.
- The calf weighs about 90 pounds.

TECHNOLOGY USE IMPROVES efficiency, sustainability

by Levi McPhillips

VIDEO

Use of technologies in the beef industry safely increases the production of red lean meat, helping ranchers and feedlot operators reach a new level of efficiency and productivity. According to Galen Erickson, Nebraska Cattle Industry Professor of Animal Science and Beef Feedlot Extension Specialist at the University of Nebraska–Lincoln, those efficiencies safely produce more meat with fewer head of cattle.

"THERE'S TREMENDOUS environmental and efficiency gains by using that technology," he said. Erickson has extensively studied the use of various technologies to improve the efficiency of beef production.

"I'm supportive of the use of technology primarily because I believe it is going to help us sustainably raise beef well into our future," he said.

"We produce the same amount of beef today with 10 percent less cattle than what we did 20 years ago. And one of the reasons for that is because we are more efficient in our production, and generally speaking, making cattle a little bigger so that we are producing the same amount of meat but with fewer cows. There are tremendous environmental and efficiency gains by using that technology."

Erickson defines "technology" as use of growth-promoting implants, beta-agonists, ionophores and antibiotics in the production of beef animals.

GROWTH-PROMOTING IMPLANTS

Growth-promoting implants, Erickson explained, are small pellets containing one or two hormones approved for this use. Pellets are placed under the skin of the animal's ear as one dose, where the substance is released slowly over time. These implants help cattle to grow larger, increasing producer profits and producing more red meat with fewer animals, which is more environmentally-friendly.

"It is, by far, the technology that has had the biggest impact on beef production," Erickson said.

"If you take cattle across 100 days and you implant this one and you do not (implant) the other one in the same 100 days, the implanted cattle will be 50-60 pounds bigger," Erickson said. "Basically, it changes the metabolism and allows the steer to get bigger and put on more weight. And that is why they are so economical."

His research, as well as research conducted by the U.S. Food and Drug Administration (FDA), have determined there are no nutritional differences caused by implants and there are no safety concerns with their use.

"There is no scientific concern when you consume meat from cattle that are implanted versus not," explained Erickson.

In addition, Erickson said consumers do not need to be concerned about any excess hormones in the meat. "There is a reason that implants are only approved to be put in the middle third of the ear, and the reason for that is because ears are discarded during the process of harvesting cattle for beef. Again, even if there is an implant in the ear, that never ends up in the food supply."

FEED ADDITIVES

"Feed additives have some very strict rules, and there is a tremendous amount of safety built into the system for the use of feed additives," Erickson said. "From a safety perspective, there's a reason we have those rules. Even myself — as a Ph.D. nutritionist — I can't tell a producer to feed this differently than what's approved. It's illegal."

A common feed additive is the beta-agonist.

"Beta-agonists are a compound that we can feed to cattle, and it is fed at the end of the feeding period in very small amounts in the diet," Erickson stated. "Those cattle can put on more weight, but they are not putting on more weight because of the product. The product changes the internal metabolism just a little bit for the cattle, and that allows them to put on more lean meat."

Producers must follow the label directions for their use, he said.

"But the levels that we are feeding, there is no residue in the meat, and there is no risk for humans when you consume a steak from a steer fed a beta-agonist versus one not fed (the additive)," he said.

Ionophores are another common feed additive, Erickson said. There are many different kinds of microbes that live in the multi-stomach digestive system of cattle. These microbes help the cattle digest the grass or forage that they consume. Some of the microbes in their stomachs digest cellulose, which is found in grass and hay, and some microbes digest starch, which is found in grains such as corn, he said.

"By feeding ionophores, you change the microbes in the rumen just a little bit, and you end up getting more good energy produced," noted Erickson. "Feeding ionophores will improve efficiency 5 to 10 percent. So you basically use 5 to 10 percent less feed than what you would if you did not use the compound."

Another feed additive is given to control mating behavior in heifers. This compound — melengesterol acetate (MGA) — helps suppress estrous, Erickson said. When a heifer is in heat, cattle of both genders may try to mount the heifer, which may result in injury to all involved. The compound that is fed to the heifers keeps them from cycling and thus, protects them from the behavior that could harm them. The compound has been approved since the 1960s, Erickson said, and works well to control mating behavior.

ANTIBIOTICS

Sometimes cattle get sick, just like humans, and require an antibiotic to get well. Antibiotics can be used in cattle when necessary — but by law, only for a short time, Erickson said.

"It would be like having an infection, going to the doctor, getting an antibiotic, and taking it for 10 days. If cattle have an infection and we want to control it, you can either give them a shot of antibiotic or you can feed those antibiotics according to their label, which is the law," Erickson said.

Antibiotics are mostly used in cattle to control bacterial infections such as pneumonia or intestinal infections, Erickson said.

ORGANIC, NATURAL AND OTHER NICHE MARKETS

There are many methods of raising beef cattle that have been developed to produce beef without the use of technology. These programs were created to provide for consumers who prefer that their beef not be raised using implants, beta-agonists, ionophores, or other feed additives. One of those programs is organic beef production. Erickson believes that having choices for consumers is a good thing.

"First and foremost, I think that from a strict national perspective it is great that we have different options for consumers," he said.

"If someone would never eat beef unless it is from organic production, I think it is great that we have some organic producers that then serve those consumers that would only buy beef in that case," he added.

Erickson said organic beef production is a program certified by the United States Department of Agriculture (USDA). There are specific rules that have to be followed by organic producers. No implants or feed additives can be used to raise organic beef. In addition, those cattle have to be given feeds that were raised organically.

Erickson said there is a difference between organic and grass-fed systems.

"There are very strict requirements on organic production systems. Organic is not grass-fed or grain-fed. That does not mean the cattle are grass-fed or never fed grain; it just means that they are fed organic feeds, whether it is grasses or grains."

"Natural" is another term used to describe what Erickson calls a "branded" program. There are no official rules for the production of beef advertised as "natural," he said. Normally, it means no use of feed additives or growth promoting implants. However, there are no official rules from USDA for producers to follow in raising "natural" beef.

Another program created to fill a market, Erickson said, is Non-Hormone Treated Cattle (NHTC). Erickson said this program was created to provide export beef to European countries because beef from implanted cattle is not allowed in the European Union.

TECHNOLOGY IN THE FUTURE

Erickson supports the raising of cattle for different markets, but is concerned that many consumers avoid eating conventionally-raised beef for the wrong reasons.

"Many people perceive that organic is healthier for you to consume, that it is more nutritious, that it has more nutrients in it, etc. The scientific evidence is not there to support that. There is no scientific evidence that there is any difference in beef raised using approved feed additives, or using growth promotants, versus using an organic production system or a natural production system," Erickson said.

Erickson believes that current production and future beef production are dependent on technology to increase efficiency and decrease environmental impact.

"If you are concerned about the environment as I am, we need to figure out ways to produce more food on the same or less resources. Otherwise we will not produce enough food to feed the human population in the future. I have some very real concerns how much beef we can produce in the future if beef producers are not allowed to use technology in beef production," Erickson explained.

According to Erickson, consumers can eat conventionally raised beef with total confidence in the safety and research that has been done.

"Most importantly, I think it is important for consumers to understand that there is a lot of science and safety that goes into the use of feed additives and technology for beef production," Erickson commented. "Ultimately our goal is to help beef producers become more efficient. But why is that our goal? Because more efficient beef production means we use less resources to raise the same amount of beef or even more beef, and I think that has been a tremendous success here in the U.S. over the last 40 years."

50 YEARS OF BEEF NUTRITION:
'this is the place where it comes together'

by Levi McPhillips

VIDEO

During his nearly 50-year career as a cattle nutritionist at the University of Nebraska–Lincoln, Terry Klopfenstein has helped bring Nebraska to the center stage of global beef production. Klopfenstein is well-known in both the cattle feeding industry and the science community for his research with protein metabolism in cattle and feeding coproducts from corn ethanol production.

"THE BIGGEST CHANGE

I've seen in the cattle industry in my 48 years is what the ethanol industry did," said Klopfenstein. Ethanol can be made from corn, and distillers grains are one of the main coproducts of that process. Klopfenstein was one of the researchers who helped get distillers grains into the diets of cattle in feedlots.

Klopfenstein's research helped discover the nutritional advantages to feeding some distillers grains in place of corn. The starch has been taken out of the corn, he said, which leaves about one-third of the original corn seed. "All the nutrients have been concentrated," said Klopfenstein. Many years of his research have been dedicated to experimenting with distillers grains and how it can be used economically at all stages of beef production.

THE VALUE OF PEOPLE

The cattle industry, according to Klopfenstein, has seen many changes since he started working at UNL in 1965. However, Klopfenstein understands that beef production has not lost what he says is its most important element, which is the human element. Cattle producers are still very hardworking, and that is what drives the success of the beef industry, according to Klopfenstein.

In his teaching and research he has seen the qualities in students that are necessary for work in the cattle industry.

"Work hard. Get along with people, and have a passion for the industry," Klopfenstein said. "Quite frankly, if you don't have a passion for it and if you don't want to work hard, then it's not the place to be."

Many of Klopfenstein's former students also have made contributions to the beef industry. One of his former students is now a faculty member at the University of Nebraska–Lincoln. Galen Erickson is Nebraska Cattle Industry Professor of Animal Science and Beef Feedlot Extension Specialist. Erickson says that Klopfenstein helped him become the professor he is today.

"In graduate school, Terry Klopfenstein was a tremendous mentor and cared a lot about students. He really helped mentor me," Erickson said.

THE LOAD CELL

Klopfenstein has seen many changes in technology in the last 48 years, including what he believes to be one of the great technological advances in cattle feeding: the load cell. The load cell is a kind of scale used to weigh feed. This technology consists of several cells that detect the tension created by the weight of the feed. The weight of all of the sensors is added together, and then it is displayed on a screen, Klopfenstein said. The load cell gave feedlots a faster and easier method of measuring feed. Klopfenstein said he believes the ability to weigh feed on a truck was one of the most important technological advances for the industry.

"The load cell on a feed truck revolutionized things because then you could weigh feeds in, and then you could weigh out," he said.

The concept of the modern feedlot was originated around this time. Many feedlots use custom feeding to minimize risk. In custom feeding, outside investors buy the cattle. The owners of the feedlot sell the feed, and they sell the service of feeding the cattle. The load cell allowed

BEEF bites

Ethanol production from corn produces both ethanol and distillers grains, a nutrient-dense cattle feed.

them to keep track of the amount of feed that was used so it could be recorded and charged to the cattle owners, he explained.

KLOPFENSTEIN ON THE ENVIRONMENT

There is the perception that there is an environmental cost to producing corn, he said, including the fossil fuels needed to plant, irrigate and harvest. There's also the fact that cattle produce methane.

"So, any time we can make the whole system more efficient, that's environmentally friendly," Klopfenstein said. "And I think it's very important that we consider the environment in all of our research."

Klopfenstein and his UNL research colleagues have been working on producing methane from manure as an energy source, as well as reducing methane production by cattle.

"We have some baseline information and now, it's going to take some innovative young animal scientists to say 'okay, here are our ideas. Here are some things that we can do,'" he said.

DROUGHT RESEARCH

The drought of 2012 brought a new challenge to Klopfenstein's research. The lack of precipitation caused a shortage of forage, which is essential for the diets of cattle. Some sources of forage include grass, hay, corn stalks and alfalfa.

Klopfenstein said that the forage shortages were more concerning than reductions in corn supply. "Eighty-five percent of what goes into producing that animal is forage. Nebraska farmers produced a lot of corn this year because we have irrigated corn, but didn't produce a lot of forage this year. That's changed things dramatically." Klopfenstein and other UNL researchers have improvised to help producers find adequate forage for beef cattle diets.

Klopfenstein said that cattle producers have used other sources of forage.

"Seventy percent of our corn, in a normal year, comes from irrigated acres. Nebraska corn production is fairly reliable because of the irrigation," he said. "The forage that we're producing is corn residue." Residue includes all of the parts of the corn plant besides the seed, and cattle graze on corn fields after they have been harvested.

Corn silage also was used heavily because it is an economical way of using corn plants for forage in cattle diets. Corn silage is obtained by harvesting the entire corn plant, including the leaves, stalk, grain, and husk, which are mechanically chopped into very small pieces. It is then gathered in a large pile and covered to prevent oxygen exposure. This airtight environment allows bacteria to feed on the silage and produce lactic acid. This acid turns the corn silage into a more nutritious product for the cattle.

"We harvested this year about 50 percent more corn silage than normal in Nebraska. Some of that was because the drought-damaged corn wasn't going to produce any corn, so it was cut for silage. But some of it is because we were looking ahead and seeing that silage was an economical way to harvest residue," Klopfenstein explained.

Top: *Cattle feed awaits use, secured by a tarp weighted down with tires.*
Bottom: *Distillers grains, a nutrient-dense cattle feed*

Klopfenstein understands how all of the research comes together. His research with distillers grains and corn residue has helped develop economic feed rations for feedlots. "What's neat about it is the combination of the distillers grains and the corn residue — that's a great feed. There are some combinations there that can really work," Klopfenstein said.

FROM ONE TEACHER TO ANOTHER

After finishing his undergraduate, graduate and doctoral degrees at Ohio State University, Klopfenstein came to the University of Nebraska–Lincoln to do a post-doctoral program in 1965. "My family came along, believing we would be out in this great American desert for three years, and then we could go back to civilization. I'm joking, of course, but Nebraska was a long ways away from Ohio. I've been here for about 48 years now, based on coming out for a three-year post-doc."

Klopfenstein has inspired many in the animal science community, but he had inspiration of his own while studying at Ohio State University. "Bill Tyznik was my adviser including all the way through graduate school. He had a tremendous influence on me in two ways: his passion for animals and a passion for teaching."

Klopfenstein used his adviser's teaching methods when he became a professor. Tyznik used oral exams to help teach graduate students to structure their thoughts and responses. Klopfenstein said he used this concept to help his own students gain interpersonal and teaching skills.

Even after 50 years of research and teaching, Klopfenstein says he still has passion for Nebraska beef production, and he says he believes that Nebraska is one of best places in the world to produce beef.

"I have a passion for teaching students that want to be involved in the cattle industry. And I have a passion for the cattle industry in the state of Nebraska," Klopfenstein said. "This is the center of the cattle industry. We've got everything here in Nebraska, and this is the place where it comes together. And in the future, Nebraska will be the leader in the cattle industry."

RICK FUNSTON, UNL reproductive physiologist, implements production practices in beef systems management, finding ways to help beef cattle producers be more profitable. Research is wide and varied, including fetal programming, heifer development, effects of calving date on economic return, weaning date, and grazing and supplementation practices.

Funston conducts his research from the UNL West Central Research and Extension Center (WCREC) in North Platte, Neb., which includes the Gudmundsen Sandhills Laboratory near Whitman. Elmer and Abbie Gudmundsen gave the 12,000-acre ranch to the University of Nebraska Foundation in 1978. The area has been adapted to still function as a working ranch that funds itself, but also operates as a university research facility.

CHANGING CALVING TIME

Funston and his colleagues have researched calving time and how that affects the entire beef system. The traditional calving time in Nebraska is March and April. Funston has compared data from cattle that give birth in March and April with cattle that calve in May and June.

"Two things really drive later calving," Funston said. One of those drivers is input costs, which continue to rise. Later calving may allow ranchers to graze cattle year round with minimal supplementation. The other driver is that later calving usually avoids weather events like snowstorms, which can be devastating to the calf crop, especially where facilities and labor are minimal, Funston said.

"We've done a lot of work with calving at different times of the year," he said. Calves born in the traditional cycle of early spring, Funston said, are weaned in the fall and go directly to the feedlot. Calves born later are lighter at a traditional weaning age. These animals usually are placed into a yearling system, grazing with minimal supplementation over the winter through the following summer and enter the feedlot that next fall.

"Running those calves over as yearlings stretches the growth curve," Funston said. It also provides marketing opportunities during periods of decreased feeder calf supplies and may increase profitability. Changing the calving season so cows calve in May or June, as opposed to March, matches the best-quality nutrients with the mother's peak lactation. One potential disadvantage, Funston said, is that forage quality is declining during the breeding season of later-calving cows, possibly resulting in a higher percentage of younger animals that do not become pregnant during the breeding season. The older (4-years and older) cows appear to have similar pregnancy rates as our earlier-calving cows, he said.

Funston is researching ways to overcome those dietary inadequacies through supplementation during the breeding season. One such supplement is a manufactured "cube" of a rich protein source, comprised mostly of distillers grains, which is a coproduct of ethanol production. When supplements are fed to later-calving heifers and young cows just before and during the breeding season, he said, it can result in a 20 percent improvement on the heifer calves and as much as 30 percent on the first-calf heifer pregnancy rates, Funston said.

FETAL PROGRAMMING

Another part of Funston's research is fetal programming, which is a maternal stimulus or stress at a critical period in fetal development that can have long-term impacts on the offspring, Funston said.

"A lot of times producers only focus on the cow, but producers may want to rethink these nutrition strategies and focus also on the developing fetus," he explained. Nutrient requirements increase during the last third of gestation, when fetal growth is greatest. In a winter grazing scenario, supplemental nutrients are often needed. Calves from cows that do not receive supplementation while grazing winter forage, Funston said, may be affected in many ways. Research has demonstrated that cows not supplemented during late gestation had heifer calves with lower pregnancy rates, and steer calves with decreased weaning and carcass weights in addition to decreased marbling and quality grades.

HEIFER DEVELOPMENT

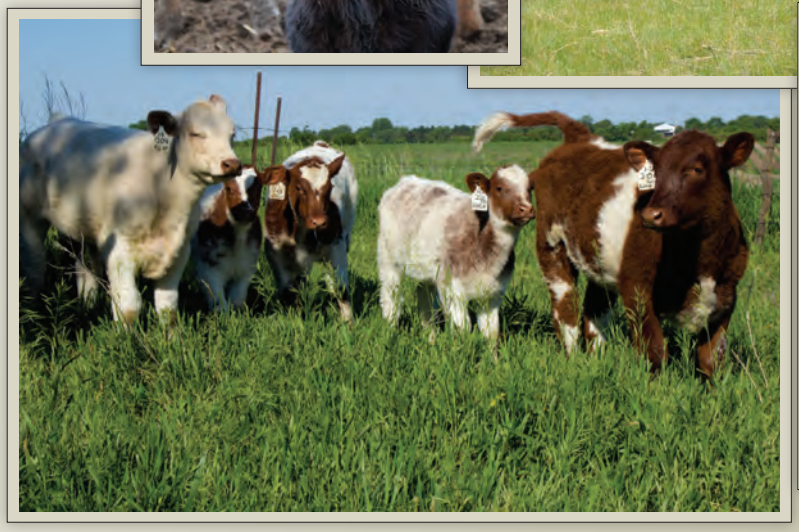
One key to profitability in the cattle business is the reproductive capability of female animals, which is Funston's specialty. The heifer enterprise is an additional potential profit center for ranchers, he said.

CHALLENGING TRADITIONS
changing cow-calf production

VIDEO

by Levi McPhillips

Many things about the cattle industry are the same as they have been for years, but University of Nebraska–Lincoln researchers are tweaking some of the traditional methods of raising cattle so producers can be more profitable.



Traditionally, producers have been told that heifers need to be at least two-thirds of their mature weight going into breeding, or conception rates may be affected. However, Funston shared some trial data indicating that heifers at 50 to 55 percent of their mature weight can conceive, if they are gaining weight at breeding.

In their research, Funston said, every heifer is kept and has an opportunity to be in the herd. However, the heifer must become pregnant on a low-input development system with a short breeding season. In a trial comparing heifers developed in a drylot with those developed on corn residue, the heifers developed in a drylot were 110 pounds heavier at breeding. The heifers developed on corn residue gained just under a pound a day, but when they all went to grass, the corn residue heifers gained nearly a half-pound more a day than the drylot heifers.

"With the drylot heifers, you put more feed and yardage into them, but they don't do as well when they go to grass," he said. "When we pregnancy-checked these heifers, their pregnancy rates were similar or greater than heifers developed in the drylot. However, the corn residue heifers gained more weight during the summer grazing period. In the end, we put a corn residue-developed heifer into the system for $100 less. That is a considerable savings, given today's feed costs."

"Cattle were put here to graze," Funston continued. "These heifers will go on to be better foragers. They will gain better in the summer and producers will get better performance from them than the heifers that were developed in a drylot," he added.

Nutrition post-breeding is as important as pre-breeding, he said. When both drylot and corn residue developed heifers were in the same pasture, they responded differently depending on how they were developed during the winter, he said.

"Heifers developed at a low pre-breeding gain went to grass and responded favorably. With this low-input system, we have better gains and better pregnancy rates, so it is a win-win situation," he said. "In addition, we have been able to decrease development costs."

THE GROWSAFE SYSTEM

As a researcher, "you dream about the resources you need to conduct the research, and then you go ask the people…and we're able to get money to build something we don't have at any other research facility," Funston said. That dream was a GrowSafe system, which is a feedlot computer system that calculates and records the intake of each individual animal in the feedlot. It provides the data that is particularly needed in research settings – and the West Central Research and Extension Center has one.

Don Adams, WCREC district director, and Funston approached UNL administrators, explained the GrowSafe system and asked for funding, which was granted.

The GrowSafe system is providing the information that helps Funston and his colleagues understand how management decisions on the ranch impact an animal's ability to convert feed into a high-quality protein source and also provide profitability to the rancher.

That dream was a GrowSafe *system, which is a feedlot computer system that calculates and records the intake of each individual animal in the feedlot.*

RESEARCH AND EXTENSION

"UNL focuses on providing research-based information and resources to beef producers to help them provide an economical, safe, quality product to consumers while protecting and preserving Nebraska's vast natural resources," Funston said.

"Collectively, research within the University of Nebraska is some of the most valuable research there is for the producer in Nebraska, and throughout the United States," he added.

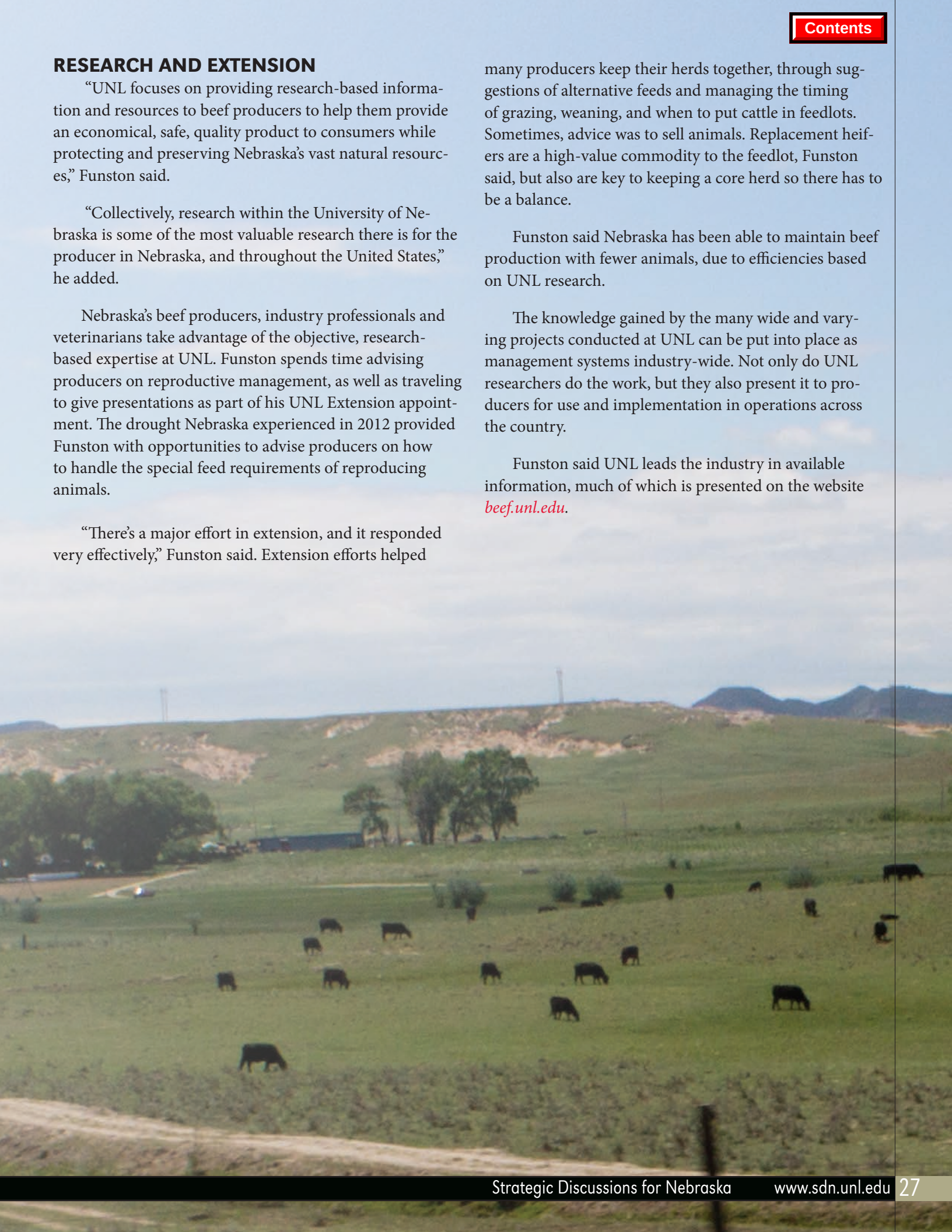
Nebraska's beef producers, industry professionals and veterinarians take advantage of the objective, research-based expertise at UNL. Funston spends time advising producers on reproductive management, as well as traveling to give presentations as part of his UNL Extension appointment. The drought Nebraska experienced in 2012 provided Funston with opportunities to advise producers on how to handle the special feed requirements of reproducing animals.

"There's a major effort in extension, and it responded very effectively," Funston said. Extension efforts helped many producers keep their herds together, through suggestions of alternative feeds and managing the timing of grazing, weaning, and when to put cattle in feedlots. Sometimes, advice was to sell animals. Replacement heifers are a high-value commodity to the feedlot, Funston said, but also are key to keeping a core herd so there has to be a balance.

Funston said Nebraska has been able to maintain beef production with fewer animals, due to efficiencies based on UNL research.

The knowledge gained by the many wide and varying projects conducted at UNL can be put into place as management systems industry-wide. Not only do UNL researchers do the work, but they also present it to producers for use and implementation in operations across the country.

Funston said UNL leads the industry in available information, much of which is presented on the website *beef.unl.edu*.



CATTLE REPRODUCTION takes another step toward a brighter future

by Jasmine Rogers

VIDEO

The beef industry drives Nebraska's economy, and to ensure profitability of producers each cow must produce a calf each year. Without this efficiency of females, there is reduced sustainability of producers, which would weaken the beef industry. Andrea Cupp, a professor of animal science at the University of Nebraska–Lincoln, specializes in reproductive physiology to assure Nebraska producer sustainability and the future of the beef industry.

IT IS IMPORTANT to get female beef animals pregnant, enabling as many as possible to have one calf per year, Cupp said. Currently, the conception rate is 90 percent, but 30 percent of those pregnancies are lost prior to having a live calf. Thus, part of what Dr. Cupp's research is trying to determine are factors that cause this loss during pregnancy. A live, healthy calf means money in the producer's pockets and more beef for a world that is increasingly hungry for the high-quality meat products produced in Nebraska.

UNDERSTANDING REPRODUCTION IN CATTLE

Historically, beef animals have been selected for certain traits and bred to produce calves that may be larger, produce better-marbled steaks, use feed more efficiently, or any number of other traits. In the process, Cupp said, selection may have worked against enhancing reproduction. Her work is focused on changing that.

Cupp said there are many similarities in human reproduction and animal reproduction. And just like humans, sometimes technology is needed for a cow to maintain a healthy pregnancy and deliver a healthy calf.

"A lot of those techniques that we develop in human reproduction we can utilize in other domestic animal reproduction," Cupp said.

Cupp's research has focused not only on increasing the number of live, healthy calves born each year, but also on the fertility of individual animals. She has learned through her research that female cows that have more antral follicles,

or more follicles on the ovary, appear to be more fertile than those with fewer antral follicles.

"So, we do believe that the excess androgens are causing these cows to be infertile," Cupp said. "We're really excited about this model and the potential for not only increasing cattle reproduction by studying them, but also the potential for translating what we find to enhance fertility in women."

> ***"A lot of those techniques** that we develop in human reproduction we can utilize in other domestic animal reproduction."*
>
> *— Andrea Cupp*

Another area that is expanding in reproductive technology is being able to sex semen. That capability is now allowing researchers to determine whether a male or female calf will be produced.

"We can actually take sperm and we can determine whether that is X-bearing sperm or Y-bearing sperm," Cupp said. Individual cattle producers do not use the technology yet, but she believes they will be in the future.

What that will enable producers to do, according to Cupp, is be able to choose how many male or female progeny the herd needs in order to maintain the appropriate balance.

DEVELOPING THE PASSION

Not only is Cupp a researcher, but she also is an educator who enjoys seeing her graduate students solve reproductive research problems and develop into the next generation of researchers and teachers.

Cupp hopes her research will be able to bring in more funding for the university, give scientists a better understanding of the reproductive system in cattle, and help change the system to improve reproduction, solving problems not only in animals, but also in humans.

"There are going to be a lot of different jobs in the future for people in the field," she said. "However, as I tell all of my students ... whatever you decide to do you need to have a passion for doing it. And if you have a passion for reproduction, the future is really bright."

BEEF IS CRITICAL to the economy of the U.S. and to the global economy, said Matt Spangler, associate professor of animal science and extension beef genetics specialist at the University of Nebraska–Lincoln. Spangler's research and outreach programs focus on the development and deployment of genomic tools to the beef industry.

Use of these genetic selection tools results in the ability to select for animals that efficiently convert feed to high-quality protein, using fewer resources to achieve the same or more output, which aids in global food security.

"If we can improve feed utilization in beef cattle, not only can we improve the competitiveness of beef cattle relative to other potential protein sources, we can also decrease the amount of harvested feed that needs to be used to maintain them, and hopefully increase food availability," he explained. Improved efficiency, from a producer's standpoint, directly impacts profitability, Spangler said, since producers can get more output with less feed.

Feed efficiency and improved profitability are just two reasons for this research, Spangler said; a deeper reason is to improve animal health and well-being, which also helps to increase production and results in safer meat products. If beef can be produced more efficiently, that cost savings can be passed on to the consumer, he added.

The bovine genome already has been mapped, Spangler said, and some of the information is easily found in the scientific literature. But Spangler and his colleagues are not interested in just one DNA marker; they are interested in the total effect of the tens of thousands of DNA markers and the cumulative effect of these markers on beef cattle production traits.

USDA GENOMICS PROJECT

Spangler is working on a collaborative project to improve feed efficiency in beef cattle that is funded by the U.S. Department of Agriculture's competitive grants program. The USDA also funded similar projects aimed at improving feed efficiency in other livestock species such as swine and dairy cattle.

"The overarching goal is to enhance global food security by improving feed efficiency in these critical livestock species," Spangler said. The project involves researchers from multiple U.S. educational institutions, all bringing their skills to develop genetic selection tools for feed efficiency in these animals. Spangler's focus is on beef cattle — and the amount of genomic information is enormous.

Just to put the enormity of the research data into context, Spangler said that each animal is genotyped for a minimum of 50,000 DNA markers. If there were to be just a few hundred animals in a research study, including their genotypes for 50,000 markers, "you would crash your laptop when you opened it," he said. The USDA research study includes not just hundreds, but thousands of animals that have at least that amount of information. The computational requirements for the necessary bioinformatics have developed rapidly, out of necessity, Spangler said.

Researchers have collected DNA samples from animals' hair, blood or semen, as well as collected individual feed intake records, on more than 10,000 beef cattle from a variety of breeds, including Angus, Red Angus, Hereford, Simmental, Limousin, Gelbvieh, Charolais and Wagyu. The researchers have genotyped the animals and analyzed them using genomic assays that include up to 800,000 DNA markers per animal.

These breeds, he said, have been different for hundreds or thousands of years. Consequently, the effect and frequency of individual DNA markers differ between them. One goal of the research is to develop robust genomic selection tools that can be used across breeds.

"We've been able to learn a lot about the actual genetic architecture of some of those traits," he said.

The researchers are studying genetic variations that exist in animals naturally, Spangler said. These variations, or mutations, occur every time a new generation is born. The researchers are identifying those variations that have a measurable effect on production phenotypes and making use of them to select animals that are more likely to display desirable traits such as increased feed efficiency.

"Already we're seeing that we can explain upwards of 40 percent of the genetic differences for feed efficiency using this genomic information," he said. Individual breed associations are planning on implementing the research. This research, Spangler said, goes all the way from discovery to application.

"We're taking things that are very basic science and taking it all the way to industry and showing them how to implement it," he said.

APPLYING SCIENCE TO ANIMALS, HUMANS

Genomic research is an improvement in technology over the simple animal breeding decisions made centuries ago by the earliest livestock producers, Spangler said.

CATTLE GENOMICS RESEARCH
aids sustainability, profitability

VIDEO

by Mary Garbacz

Based on an interview by Monica Casey

Traditional science, meet the new-age science at the University of Nebraska–Lincoln.

For hundreds of years, livestock producers have selected animals to breed that result in offspring with both parents' desirable traits, such as taller or heavier animals. New-age science uses genomics, in which researchers collect and study the DNA of animals to make informed decisions that enhance animal populations.

using DNA information; he also can analyze a carcass sample and trace it back to the specific animal.

"That kind of traceability provides a safer product," he said.

Genomic technology also is used in human medicine.

"The whole idea of utilizing genomics is happening in human medicine," he said. Genetic testing may determine that a person may have a genetic predisposition to cancer, for example. Certain treatment regimens can be implemented based on how they may work best for that person, he added. An individual who is found to be genetically likely to develop a certain disease may be advised to eat certain foods, take specific vitamins or take a more proactive approach to prevent the onset of the disease.

Today's producers can use these genomic selection tools accurately and efficiently, selecting animals that are genetically superior for traits such as fertility, susceptibility to disease, growth and carcass characteristics.

"These technologies enable us to make improvements in traits that not only increase the profitability of beef cattle producers, but they also can add to providing a reasonable cost, safe and healthy product to consumers," he said.

Genomic information also can be used to influence management decisions, such as altering the diet of beef cattle based on their genetic background to optimize performance, meat quality traits, or which vaccinations should be given to an animal based on its genetic susceptibility to disease.

DNA information also can be used to genetically change characteristics such as the fatty acid profile of beef, its iron content or its calcium content – all of which are heritable traits, he said. DNA information also is used to identify animals and corresponding meat products. Spangler said he can match an animal back to its parent

EDUCATING THE PUBLIC

Just understanding how to use the wealth of genomic information presents great opportunity, Spangler said; not only opportunity to use genetics to improve the lives of animals and humans, but also opportunity to educate the general public about the need for this kind of science.

"I think in some cases, when people hear about using this information in livestock settings, they think of genetic engineering," he said.

That is not the case.

"The fact is — we're doing what we've always done — trying to improve genetics."

The difference is that the new-age science is focused, efficient and accurate.

"These kinds of discoveries are going on that can improve livestock populations and human populations," Spangler said. "I think that's very exciting."

BEEF bites

The beef industry produces the same amount of beef today with 10 percent fewer cattle.

THE SCIENCE of managing tough times

by Sydney Hansen

VIDEO

"The University of Nebraska–Lincoln is amongst the world's leaders in terms of dealing with and helping ranchers manage impacts of drought," according to Don Adams, director of the UNL West Central Research and Extension Center (WCREC) in North Platte, Neb., located in Nebraska's Sandhills.

THE SANDHILLS is mile after mile — more than 19,000 square miles — of rolling, grassy hills where many of Nebraska's cattle graze; hills that overlie the deepest part of the Ogallala Aquifer.

But if severe drought occurs and the grass stops growing, the center's specialists are available to help ranchers with research-based management techniques and education programs.

Adams and others at WCREC help agricultural producers work through the issues associated with limited water conditions, such as low forage supply, and help them to make economic decisions that allow them to stay in business long-term, he said.

"When serious drought comes, it often requires cattle producers to make some pretty significant changes," Adams said. Those changes usually are related to a reduced forage supply for cattle feed, as well as reduced nutrient content in the available forages.

When WCREC specialists look at helping ranchers work through these situations, one of the first things they do is find ways to extend existing resources to meet the nutrient needs of the cows. Maintaining cows in a condition so they become pregnant and produce healthy calves is essential, Adams said. This has to be accomplished economically so ranchers can maintain profitability.

"The other thing we are very good at, at the University of Nebraska–Lincoln, is helping ranchers recover from the drought," Adams said, including helping ranchers determine when and how to re-stock pastures and at what level, so the Sandhills grasslands are maintained into the future.

"We use research-based tools, as ranchers come in, to help them make some of their decisions," Adams said. At the center, there are resources available for beef cattle re-

The Sandhills is mile after mile *— more than 19,000 square miles — of rolling, grassy hills where many of Nebraska's cattle graze; hills that overlie the deepest part of the Ogallala Aquifer.*

search, such as a 12,800-acre ranch with about 600 head of cows, he said. This research is built around using natural forages and raising beef cattle in the same conditions as do Nebraska ranchers, Adams said.

MANAGEMENT STRATEGIES

The West Central Research and Extension Center has long-term data that has been collected from previous droughts, he said, which assists him as he helps producers plan their forage supplies and identify the appropriate supplements to feed the cows. There are management decisions that ranchers can make such as weaning a calf from the cow to stretch the grazing supply, he said. There also is the option for ranchers to take their cows and move them to cornstalks for grazing during the fall and winter months, he added. Another management option is to check cows for early pregnancy; if cows are not pregnant, those cows can be moved off the ranch to help reduce numbers and stretch the forage supply, Adams said.

"When we talk about stretching the forage supply, we are really talking about reducing the amount that cattle consume on a daily basis, so that it will create more days of grazing," Adams said. Another strategy ranchers can use is mixing low-quality forages with distillers grains.

"Distillers grains have been a just wonderful protein and it's almost an ideal protein for cows," Adams said. The feeding options can get complex because the first year of a drought is different than the second year of a drought. What might be done with forage supplies in early months of drought may change as a drought persists, Adams said.

"What's been very different about the 2012 drought compared to other droughts that we have worked with, it came on as what we call a 'Flash Drought,'" Adams said; there were no early signs of a coming drought. The spring precipitation started, then ended abruptly, followed by some high temperatures, he said. These high temperatures caused the grasses to mature very rapidly and supply was reduced, he explained. There was not much of a chance to help ranchers prepare for the conditions because they came on so suddenly.

"It was almost May before people could see that we were in a very difficult situation," Adams said.

Droughts result in a lack of grass and forage, Adams said, so ranchers must buy feed and pay to truck it to the ranch, or they must find ways to conserve feeds. Sometimes prices of feed can soar, depending on availability and distance it must be transported. Reducing herd size by feeding cows in the feedlots or sending animals to market is a strategy to conserve feed in some situations, Adams said, but ranchers must consider economic effects of herd reduction, such as cash flow, tax laws that affect liquidation of cow herds, as well as the time frame of when the cows can be brought back to the ranch from the feedlots or the cornstalk grazing, he said.

Adams said the WCREC ranch lives through droughts, too, and deals with the same management decisions as area ranchers.

"We are also living it. Not only do we have data, but our cows are going through the same drought, our pastures are going through the same drought, our hay fields

The Gudmundsen Sandhills Laboratory, given to the NU Foundation in 1978 by Elmer "Pete" and Abbie Gudmundsen

are going through the same drought," Adams said. "When we talk with ranchers, we know 'real time' what's really going on; this allows us to help in a different way," Adams said.

"Our purpose isn't to make decisions, but it's to provide cattle producers with research-based information to help them work through a decision they have made; it is to help them see what the choices are and to help them identify resources," Adams said.

DROUGHT AND FAMILIES

The extension staff at the WCREC is critical in terms of helping ranchers deal with the effects of the drought, Adams explained.

"I am really concerned about this whole issue around the families," Adams said. Having the extension staff for ranchers to turn to during difficult times plays a significant role, Adams said. The drought in 2012 was so serious, Adams and the WCREC staff helped ranchers and families cope with the drought, often finding ways for the ranches to survive financially.

"When you get families that are stressed, it is important that they can find resources and that they can get some support and guidance through difficult times — extension plays a pretty significant role in that regard," Adams said. "At UNL we have some of the best information anywhere on how to manage the grass and the cow herds to get through these difficult times," Adams said.

RANCH PRACTICUM

The West Central Research and Extension Center has something that is unique to Nebraska, Adams said: the ranch practicum. The practicum is an eight-day course that allows ranchers to see firsthand the research that is conducted through the WCREC.

"It's a hands-on school where ranchers actually come to the Gudmundsen Sandhills Laboratory," Adams said. The ranchers who have enrolled in the ranch practicum have learned what is happening to the forage supply, to the yields of the crops, and what the calves are gaining in weight, he added.

CATTLE MANAGEMENT RESEARCH produces safe, affordable food

by Stephanie Smolek

VIDEO

The University of Nebraska–Lincoln provides objective, science-based information that helps producers improve their grassland cattle operations, said Karla Jenkins, assistant professor and cow-calf range management and extension specialist at the University of Nebraska–Lincoln Panhandle Research and Extension Center in Scottsbluff.

MANAGEMENT practices to improve production efficiency are tested in a research setting before recommendations are made to producers, Jenkins said. "Over time, we've certainly made tremendous improvements in supplying the world with a lot of choice, healthy beef," she added.

According to Jenkins, her goal is to help producers as they continue to produce an affordable, safe food supply.

RESEARCH FOR CATTLE PRODUCERS

Through her applied research, Jenkins studies how cattle grazing grasslands are affected by different feeding and management practices. This research is published in scientific journals, such as the *Journal of Animal Science*. Then, Jenkins produces publications, programs and webinars based on the research that producers can apply to their own operations.

Researching alternative ways to feed cattle when traditional resources are unavailable, is the most important part of her work, she added.

Jenkins works closely with cattle producers, ensuring that they are providing nutritionally balanced diets to cows in the western part of Nebraska, where grass sometimes is

scarce during periods of drought. During those times, non-traditional feed sources are used, Jenkins said. Pumpkins and sugar beet pulp are two such alternative feeds.

Sugar beets are grown and processed into sugar in western Nebraska. During processing, the sugar is removed, leaving the pulp as a coproduct. It often is used as an animal feed.

The climate and growing conditions in western Nebraska are unique to the state, but those conditions do exist elsewhere in the world, according to Jenkins. Therefore, her research could apply to other places around the world. Areas in Asia and Europe are geographically similar to western Nebraska, having a high altitude and very arid climate, Jenkins said.

GLOBAL NEEDS REQUIRE GLOBAL SUPPORT

The biggest challenge in this research is finding continual funding, Jenkins said. Currently, most funding comes from foundation grants, federal grants and gifts from private citizens, she added.

Additional funding is dependent on understanding the global effect of this research, Jenkins said.

"Anything that we do to improve the beef industry really does impact people in other countries," Jenkins said. "We are working to supply healthy foods for not only the U.S. but a global economy as well."

TRANSDISCIPLINARY RESEARCH

Jenkins' research into alternative cattle feeds, grassland cow feeding and management requires expertise from various disciplines, Jenkins said.

She works with animal scientists, entomologists, dryland crop specialists, agronomists and soil scientists to ensure resources are being used sustainably.

"We can never abuse our range or our resources," Jenkins said. "So, I have to work carefully with those people because we want to make sure that we're getting the optimum out of that land."

The university works hard to provide producers with a complete picture of cattle production, Jenkins added.

"We want to get gain out of those cattle, but we want to get a good yield out of the crops," she said. "We want to make sure that the soil profiles, the water that's in it and the nutrients in the soil, are not being depleted by the double-usage things that we do."

CONFINEMENT FEEDING AS ALTERNATIVE

Removing cows from grasslands and moving them into confinement is a cattle management practice Jenkins is researching.

Cows can be put in feedlots, Jenkins said. There, a cow's feed intake can be limited to conserve feed resources as long as the energy in the diet fed meets her needs, she added.

In confinement, a cow's diet usually includes fewer forages — like grass — and more residues — like corn stalks and wheat straw — and coproducts from crops, such as beet pulp from the sugar beet industry and distillers grains from the ethanol industry. These diets are high enough in energy to meet the cows' nutritional requirements so they do not lose weight, Jenkins said.

Confining cows is a possibility when there is no grass available, Jenkins said. However, feeding in confinement is not inexpensive, she added.

"If it (confinement feeding) can be done at least temporarily to rest the grass or allow it to have some deferred time to re-grow, then it may be a better option than selling off cattle," Jenkins said.

DROUGHT DRIVES RESEARCH

In 2012, Nebraska was part of a widespread drought across the U.S. that diminished the grassland range, which fed most of the state's cattle. Traditional grasslands and hays were not available during the dry period, Jenkins said.

"It wouldn't matter what you were willing to pay for it, it didn't exist this year," Jenkins said. Producers turned to Jenkins for suggestions of alternative feeds. If producers cannot find feed sources for their cows, they will be forced to sell them, Jenkins said.

During many droughts, cows may be sold and moved to other areas in the U.S. that are not affected by the dry climate, or hay from these areas is moved into the state. However, these were not options in 2012, Jenkins said.

Most of the U.S. was affected by the drought, she added. Many of the cows that were sold were harvested.

Liquidation of cattle herds is never a good thing, Jenkins said. The goal of alternative feeding research is to help producers keep a core cow herd so when growing conditions are better, there will be breeding stock available to grow the herd.

"Nebraska's a beef state," she said. "So, it's very important for us as a state that we are able to sustain the cow herd." Sustaining cow herds helps Nebraska producers sustain the supply of meat not only to the U.S., but to the world, which also feeds Nebraska's economy.

ADDITIONAL CATTLE MANAGEMENT OPTIONS DURING DRY PERIODS

Jenkins also is researching whether it is possible to grow forages on irrigated cropland after the crop is harvested and before it is replanted the following year. If this is possible, producers could take advantage of water that is already present, she said.

Additionally, when feed is limited, anything that is possible to include in a cow's diet is fed to them, Jenkins said.

"I've had producers bring me the forage analysis on weeds that they baled up, and we have to test them for any toxins that are in there, as well as the nutrient quality, to try and figure out how best to incorporate those into the diet," she said.

During 2012, some dry edible beans in western Nebraska frosted before they were mature. They were not acceptable for the human market, but were safe for cattle consumption, Jenkins said, so they were worked into cattle diets, she added.

According to Jenkins, there are several alternative feeds that are safe for cow consumption and more readily available during dry periods. She said these include:

- beet pulp, a coproduct from the sugar beet industry
- distillers grains, a coproduct from the ethanol industry
- corn stalks
- wheat straw
- dry edible bean straw

"We try to help people think outside of the box — how they might come up with some forage resources," Jenkins said.

CATTLE DIGESTIVE SYSTEM

It takes 1 to 3 days for food to pass through a cow's digestive tract, depending upon what it eats. A cow briefly chews food as it eats, breaking it into smaller particles. Since digesta flows freely between the reticulum and rumen, these compartments are collectively referred to as the reticulorumen. The reticulorumen contains more than 50 percent of the total digestive tract capacity.

1 ESOPHAGUS
clump of dehydrated food (cud) is regurgitated back into the mouth for further chewing

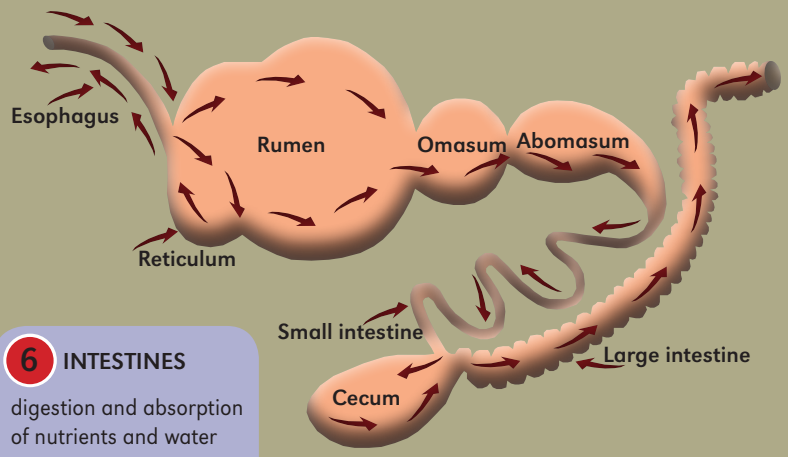
2 RUMEN
collects all swallowed food (plant matter), separates into solids and liquids, fermentation process begins

3 RETICULUM
further fermentation

4 OMASUM
absorption of fluids

5 ABOMASUM
"true stomach" digestion of proteins

6 INTESTINES
digestion and absorption of nutrients and water



ENVIRONMENTAL SUSTAINABILITY
drives feedlot research

by Stephanie Smolek

VIDEO

University of Nebraska–Lincoln feedlot research is aimed at discovering long-term sustainable practices.

As stewards of the Earth, feedlot managers and owners in Nebraska seek this information, said Matt Luebbe, assistant professor of animal science and feedlot nutrition management specialist at the UNL Research and Extension Center in Scottsbluff, Neb.

FEEDLOT MANAGERS and owners want to use their resources efficiently in an attempt to minimize their operation's environmental footprint, he added.

Efficiency, sustainability and profitability of beef animal production at feedlots, therefore, guide Luebbe's research.

Specifically, he studies different methods to meet the nutritional needs of feedlot cattle. He also analyzes manure to determine which nutrients in cattle feed are being digested efficiently and how this manure can be used in plant crop systems.

Improving the efficiency of feedlot cattle diets leads to a more sustainable system and improves the environmental effect of feedlots, Luebbe said.

For example, in order to meet his goal of further reducing greenhouse gas emissions from feedlots, Luebbe said research must focus on improving cattle's digestion and use of feed.

Luebbe also researches water use at feedlots. Ultimately, he said, he hopes to assist with research into how much water it takes to raise a pound of beef. This kind of discovery would require research from all segments of the beef industry, he added.

YEARS OF RESEARCH AND COLLABORATION

According to Luebbe, nutritional efficiency at beef cattle feedlots has been improving since the industry's inception. Technologies and management strategies have evolved to advance the industry, he added.

The research Luebbe is doing could rapidly change the industry; however, to answer questions such as how much water it takes to raise a pound of beef, research data must be collected for multiple years in order to solidify results.

UNL Feedlot School

"If we tried to condense it too much, we're making too many estimations or guesses," Luebbe said. "The end result would be only as good as what our guesses are."

Feedlot water efficiency and feed efficiency research also involves collaboration with multiple specialists in animal science, meat science, veterinary science, agronomy and engineering, Luebbe said.

These specialists' expertise has a direct influence on feedlot cattle research and benefits the feedlot cattle industry, he added.

For example, engineers aid in the discovery of new manure management techniques and beef cattle feedlot building design systems, according to Luebbe.

"I think it's very rewarding that I can work with these different disciplines and get their expertise so that we can solve a problem," Luebbe said.

RESEARCH IS SHARED WITH THE INDUSTRY

Luebbe is also involved in extension at the university. Research results are shared with producers in several different formats so they can implement this information in their own operations.

The primary way for producers to obtain this research information is through extension meetings, Luebbe said. However, he also shares research information through webinars and written materials.

In Nebraska, Luebbe leads a Feedlot School, helps at the annual Husker Beef Nutrition Conference and leads beef feedlot nutrition roundtables.

Luebbe started the Feedlot School in 2011, when he joined the UNL faculty and saw that there was a gap in education opportunities offered by UNL for employees at feedlots, Luebbe said. Many feedlot employees have very limited training, he added.

The goal of the Feedlot School, which is held once a year at three locations across Nebraska, is not to explain to feedlot employees what they have to do in their jobs, but to explain why they should do their work in a specific way, Luebbe said.

This leading theme is proving to be successful, and the Feedlot School has the potential to grow, according to Luebbe.

"It's been received very well by owners and managers that want to give their crew opportunity for training," he said.

According to Luebbe, many migrant workers attend the Feedlot School. Some do not speak English and may not have finished high school, he added.

Graduate students often help translate to accommodate everyone at the school, he added.

Feedlot owners and managers have asked that the school be held in more locations in the future, Luebbe said, to make it more convenient for busy feedlot employees.

In addition to the Feedlot School, Luebbe is involved in programs at UNL that involve experts and professionals in the beef cattle feedlot industry.

The annual Husker Beef Nutrition Conference brings together leading researchers from UNL and other universities to discuss and share research on current issues in the beef cattle industry, he said.

Beef feedlot nutrition roundtables are open meetings that take place at three locations in Nebraska once a year,

Luebbe said. Feedlot owners and managers are invited to the roundtables to meet with veterinarians, economists and other experts, who can answer the owners' and managers' questions and concerns about feedlot animal health, nutrition, environment care and economics management, he added.

"As far as the questions go, it depends on what the producers are interested in," Luebbe said. "We try to encourage the conversation and let the producers talk in that roundtable setting to try to get a feel for what other people are doing to be sustainable."

Matt Luebbe

WEATHER CHALLENGES FEEDLOT INDUSTRY AND RESEARCH

Challenges in feedlot production due to weather conditions often are discussed at feedlot nutrition roundtables. These same challenges can affect research, Luebbe said.

The drought in Nebraska in 2012 led Luebbe to use and study non-traditional feed sources in his research. Combinations of feed could be used to maintain feedlot cattle performance and condition, reducing feed costs, when traditional feed sources were scarce, Luebbe said.

Historically, feedlot owners and managers have been able to obtain any feed source they wanted. They just had to pay more for it, he said.

The drought of 2012 affected the feed supply; many feed options were not available, no matter how much feedlot owners and managers were willing to pay for it, Luebbe added.

"That's a new environment for us," he said.

The economic environment of 2012 due to the drought increased the importance of relationships for feedlot owners and managers, according to Luebbe.

Many family farmers did not have the capital to sustain their cattle herds, Luebbe said. As more cattle producers sold their cattle, the overall herd numbers declined in Nebraska and throughout the United States, he added.

If there are limited cow numbers, there will be fewer calves on the market for feedlot owners and managers to purchase and put in their system, Luebbe said. Relationships are necessary to secure these calves and to secure feed sources for them, he added.

Luebbe's research after the 2012 drought looked at improving profitability for feedlot owners and managers who were struggling to stay in business.

Resources had to be used efficiently, Luebbe said.

Nebraska's beef cattle feedlot industry has a sustainable infrastructure, not seen in many other areas, which allowed many producers to control the challenges presented in 2012.

"Nebraska is the beef state," Luebbe said.

Some of the feed efficiency and management efficiency research that helped reduce nutrient and economic losses in Nebraska and will help restore the industry can also be applied to other parts of the world, where similar resources are available, Luebbe said.

LIVESTOCK INDUSTRY IMPROVED HANDLING needs to tell its story better

by Dan Moser, IANR News

The U.S. beef industry has made huge strides in livestock handling in recent years but has done a poor job explaining that to the public, said leading animal behavior expert Temple Grandin.

GRANDIN SPOKE on January 15, 2013, at the University of Nebraska–Lincoln as part of the Institute of Agriculture and Natural Resources' Heuermann Lectures.

Grandin, an animal sciences professor at Colorado State University, has had a major impact on the meat and livestock industries worldwide through her research, development and outreach on use of low-stress, behavior-based livestock handling techniques and design of animal handling facilities.

Half the cattle in North America are handled in equipment she has designed for meat plants, said Ronnie Green, Harlan vice chancellor of IANR and University of Nebraska vice president for agriculture and natural resources.

Grandin said her autism has played a key role in her work because it attunes her to visual details that can distress cattle, pigs and other livestock but go unnoticed by most people.

Changes in flooring surface, reflections, shadows, even something as simple as a dangling chain all can unnerve animals and make them harder to handle, Grandin said.

"I got down in the chute to see what the cattle were seeing," she recalled. "People thought that was crazy."

Grandin said livestock handling in the '70s and '80s was terrible, but both equipment and management practices are vastly better now. However, both the media and public still seize on occasional instances of mishandling and treat them as if they are the rule rather than the exception.

"One of the things that frustrates me is we've improved a lot of this and nobody knows about it," Grandin said. "When I first started, maybe 10 to 20 percent did a decent job of handling animals. Now it's 80 percent."

"I go into the meat plants now and it's quiet like church."

*"**I got down in the chute** to see what the cattle were seeing," she recalled. "People thought that was crazy."*

— Temple Grandin

The key for livestock handlers is to understand animal behavior to get them to voluntarily do what they want them to do, rather than exerting force, Grandin said.

Grandin also has developed animal welfare guidelines for the meat industry and consults with McDonalds, Wendy's International, Burger King and other companies on animal welfare. She said animal-welfare guidelines must be specific and clearly worded and based on what is "directly observable."

She encouraged the industry to share the progress it's made with the public.

Grandin had a unique opportunity to do just that when HBO made a movie about her life, starring Claire Danes. During Hollywood media interviews, she found reporters to be fascinated about meat processing. Thanks to that movie, Grandin is at least as famous for her triumph over autism as for her livestock work.

The Heuermann Lectures in IANR are made possible by a gift from B. Keith and Norma Heuermann of Phillips, Neb., longtime university supporters with a strong commitment to Nebraska's production agriculture, natural resources, rural areas and people.

The lectures are archived at *heuermannlectures.unl.edu*; to watch the Grandin lecture, visit the site and click on View 2012-2013 Season videos.

Books by Temple Grandin:

- *The Way I See It*
- *Different ... Not Less*
- *The Autistic Brain*
- *Humane Livestock Handling*
- *Animals Make Us Human*
- *Animals in Translation*
- *Thinking in Pictures*
- *Emergence: Labeled Autistic*
- *Developing Talents*
- *Autism & Asperger's Syndrome*
- *Unwritten Rules of Social Relationships*

STEWARDS of the land

The Sandhills is a treasure of Nebraska and a resource that deserves and requires research and education, so we manage it for long-term use and productivity.

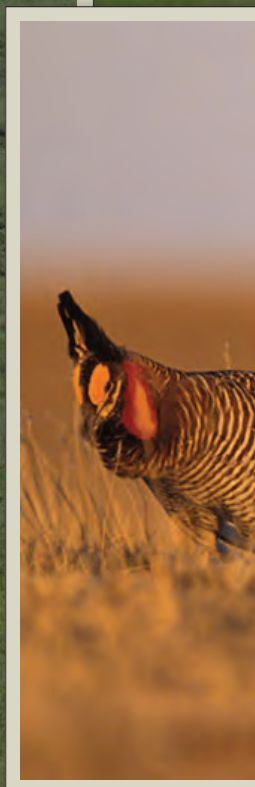
Walter Schacht
University of Nebraska–Lincoln
Professor of Agronomy and Horticulture

MAINTAINING
the Sandhills legacy

by Jasmine Rogers

VIDEO

The Nebraska Sandhills is the largest contiguous grassland in the United States, with perennial grasses and broadleaf plants that provide food for the millions of Nebraska cattle that graze there.



"IT'S CERTAINLY a treasure of Nebraska and a resource that deserves a lot of research and education. We manage it for long-term use and productivity," said Walter Schacht, professor of rangeland ecology and management at the University of Nebraska–Lincoln. Schacht studies management of Nebraska's grasslands to maintain structure, productivity and ecological sustainability.

Ecological sustainability is the "capacity of an ecosystem to maintain essential functions and processes in the long term," Schacht explained. This pertains to the diversity of the ecosystem, including soil productivity.

"With our grasslands in Nebraska, grassland ecology becomes really important," Schacht said. Grasslands like the Nebraska Sandhills have relatively low rainfall and the soils have low nutrient content, so Schacht and other specialists rely on management techniques to improve the proper functioning and processes of the grasslands ecosystem. Research focuses on long-term productivity with minimal levels of input, he said.

Schacht was hired by UNL in 1994 and as his work developed, he and other UNL specialists began to study environmental and conservation issues that affect the long-term productivity of the Sandhills.

BALANCED SYSTEM = ECONOMIC OPPORTUNITY

The balance of the ecosystem is reflected in the Sandhills' good-to-excellent condition, Schacht said, that also supports wildlife, including grasslands birds. The Nebraska state bird, the Western Meadowlark, is an upland songbird that makes its home in that region.

NEBRASKALAND Magazine/NGPC

NEBRASKALAND Magazine/Nebraska Game and Parks Commission

The healthy grasslands also can be an economic boon to the state, Schacht said, because game species like the Greater Prairie Chicken and the Sharp-tailed Grouse are in such healthy populations that there is a legal hunting season for both.

Schacht and Larkin Powell, professor in the UNL School of Natural Resources, have conducted research studies on the habitat requirements of the Prairie Chicken in the Sandhills and how cattle ranchers could add economic enterprises, such as bird-watching, hunting or other nature-based adventures to the Sandhills ranch economy.

"Upland birds could be a part of that expansion of development of other enterprises," Schacht said.

GRAZING RESEARCH

Schacht works with many other researchers at the University of Nebraska–Lincoln, including Jerry Volesky, a range management specialist located at the UNL West Central Research and Extension Center in North Platte, Neb.

Nebraska experienced a serious drought during 2012, reducing Schacht's and Volesky's plant production research by nearly one-third.

NEBRASKALAND Magazine/NGPC

"For several grazing studies, we had to reduce stocking rates and/or change the timing of grazing," Schacht said. That meant that the research had to change, as well.

Midway through summer, Volesky and Schacht began to study how much precipitation it would take for rangeland plants to recover from a summer drought.

Further studies are being conducted on whether cattle grazing on Sandhills grassland has a positive or negative effect on soil sustainability.

Schacht said that over the years, there has been concern that cattle hooves could compact the soil, especially during periods of high precipitation, interrupting the soil cycle. More recently, a hypothesis has developed that grazing animal hooves will drive into the soil the litter or dead plant material on the soil surface, thereby increasing organic matter and speeding up mineral cycling, Schacht explained. Schacht and his colleagues are conducting research to determine the relationship between different grazing strategies and soil organic matter and mineral cycling.

Nitrogen cycles through a grassland system, transitioning from a living plant to a dead plant that decomposes and mineralizes so it can once again be taken up by the plant.

"We need to understand nitrogen cycling and what factors affect nitrogen," Schacht said. Nitrogen can leach out of the soil or turned into a gaseous product that leaves the pasture system, Schacht explained.

Leaching is when nitrogen moves downward through the soil, possibly moving as far as the groundwater, if crops are over-irrigated or there is a rainy season. Nitrogen also has the potential to run off into lakes and streams. However, Schacht said that most range and pasture land is not fertilized, or is fertilized at low rates so fertilization practices on grazing lands generally have a minor effect on the soil or groundwater.

IMPORTANCE OF THE AQUIFER

The High Plains Aquifer, commonly called the Ogallala Aquifer, underlies most of Nebraska, particularly under the Nebraska Sandhills, Schacht said. The Sandhills valleys are close enough to the aquifer that during much of the season, the roots of the perennial plants that grow in the meadows actually reach the water table, he said.

"About 10 percent of the area is sub-irrigated, so 90 percent is upland, but that 10 percent is about six times more productive than the uplands in terms of producing forage for livestock production," Schacht said. "So, the aquifer, just in terms of the Sandhills grazing and forage production, it's extremely important."

There is relatively little crop production in the Sandhills, so nitrogen fertilization in the Sandhills is minimal. Because of this, the quality of the water in the aquifer is generally good, Schacht said.

UNDERSTANDING THE ecology of the Sandhills

by Jasmine Rogers

VIDEO

The cattle that graze the grasses of the Nebraska Sandhills are grazing the results of decades of University of Nebraska–Lincoln research into land management, range ecology, plant growth, water science and animal science, as well as the extension work that takes the research results to ranchers. The resulting collaborations create environmental sustainability and health of the Sandhills so cattle production can continue.

JERRY VOLESKY, a range management specialist located at the University of Nebraska–Lincoln West Central Research and Extension Center in North Platte, Neb., studies the wide variety of issues that support the cattle industry and create a healthy ecosystem in the Sandhills.

Grazing management looks at how many cattle graze a certain area of pasture and for how long; the resting period of the land; and how the environment responds to new management methods.

SOIL, WATER, GRASS – AND CATTLE

Cattle benefit from a diet of nutritious grasses, starting with healthy soil in which the grasses grow.

"Many of our studies have really begun to look at more of what's taking place with the soils – the root growth, even things like the soil microbiology," Volesky said, "including how different grazing management strategies or practices affect what's happening below ground."

Along with studying soil, Volesky and others also have researched watersheds and how water infiltrates the soil. The High Plains Aquifer, also known as the Ogallala Aquifer, underlies much of the nation's midsection, with the deepest part beneath the Sandhills. The Gudmundsen Sandhills Laboratory, where much of UNL Sandhills research is conducted, was given to the University of Nebraska Foundation in 1978 by Elmer and Abbie Gudmundsen. The 13,000 acres of rangeland is located in parts of Grant, Hooker and Cherry counties and is managed by the UNL West Central Research and Extension Center (WCREC). The Ogallala Aquifer is particularly deep beneath that multi-county area, Volesky said. That water availability is a key factor to the success of cattle production in the Sandhills.

"The Sandhills are a great recharge area for many of the groundwater aquifers," Volesky said. "Basically, they are sand dunes, but they are covered with grass." Thousands of years ago, the climate may have been different; there also may have been extended droughts.

"The cover of grass that we see on the Sandhills today wasn't always like that," he explained. The Sandhills formation includes the uplands — individual dunes or a complex of dunes or hills, and the sub-irrigated meadows of the valleys. To create a sub-irrigated meadow, the water table has to be close to the surface, Volesky said; in many cases, the water table is two or three feet below the surface.

"Plants and grasses growing in the meadow — their roots can grow down into that water table, which is a great benefit to them. It certainly increases their growth potential and productivity, and the effects of drought are much less pronounced," he said.

DROUGHT

But even the aquifer couldn't protect the Sandhills grasses from the effects of the severe drought in 2012.

Precipitation stopped suddenly in early May of that year, and record summer heat added to the drought's severity. The drought had a dramatic impact on pasture growth and production.

"Many livestock producers had to react fairly quickly in terms of choices and decisions related to the lack of pasture growth," he said. For most, that meant reducing numbers in cow herds and looking for other types of cattle feed.

As a UNL Extension specialist, Volesky was able to advise farmers and ranchers about other annual forages that they might be able to grow on cropland, if it was available, "to take some of the pressure off their suffering native Sandhills pastures," he said.

"The key thing to a lot of livestock producers is to maintain their cow herd through the drought," Volesky explained. "If they have to get to the point where they have to sell, or depopulate, too many animals it takes a long time for them to rebuild those numbers and the economic impact could be quite severe."

As difficult as the 2012 drought was, Volesky pointed out that historically, there has been drought throughout the Great Plains, and even throughout the U.S.

"A single year drought isn't too particularly devastating," he said. The worst-case scenario develops when there are multiple years of consecutive drought that affects the stability and health of the Sandhills.

"One thing — those Sandhill rangelands, they are resilient. They've experienced drought before. They bounce back," Volesky said.

UNL RESEARCH FACILITIES

Volesky conducts his research at the Gudmundsen Sandhills Laboratory and also at the Barta Brothers Ranch, a University of Nebraska research facility near Long Pine. The Barta Brothers Ranch was named for Clifford and James Barta, who gave the 6,000 acres of rangeland in Brown and Rock counties to the University of Nebraska Foundation in 1996.

Volesky has worked with other researchers in studies of the effects of grazing on rangeland plants and the plant communities, as well as how different fertilizer combinations affect the hay that is produced on subirrigated meadows.

Because of the location of the Gudmundsen facility, there also have been many water and hydrologic-related studies into water quality, groundwater movement, water infiltration and recharge, Volesky said.

Research projects at the Barta Brothers Ranch, which is managed by the UNL Northeast Research and Extension Center (NEREC), includes in-depth research on specific components of grazing systems.

Grazing and rangeland ecology studies may last 10 years or more. These long-term studies are needed to see the true impact and results of various management practices, especially because of the variability of precipitation and other outside factors and interactions, Volesky said.

One of the current studies involves graduate students who are working on specific components of grazing systems. One student is focused solely on the root growth of these different grasses and how that root growth responds to different types of grazing treatments," Volesky explained, adding that nutrient cycling research is part of the studies.

The annual cycle of above-ground growth of grass, the grazing of the grass, the growth of grass roots, the recycling of minerals and the carbon left behind all are part of the research studies.

"Additionally, another student has a component in the study that focuses on the soil microbes that live and inhabit those soils," he said, "and how the microbes respond to different conditions and grazing of the pasture/plant community."

Volesky works with Walter Schacht, a range ecology professor in the Department of Agronomy and Horticulture at the University of Nebraska–Lincoln, in research studies and in working with graduate students. Volesky and Schacht co-advise students to help them complete their research; Volesky from North Platte and Schacht from Lincoln.

Volesky said that his work with UNL Extension allows him to have interaction with ranchers and land managers, which provides a different perspective for graduate students than being solely in a campus setting.

BEEF bites

UNL Extension specialists provide research-based, objective information to producers, businesses, families and individuals.

IT ALL BEGINS WITH nutrients and water

by Jasmine Rogers

VIDEO

Each year, there are more people in the world who need to eat. As the population increases to a predicted nine billion by 2050, researchers are finding ways to increase the efficiency of food production.

TIM SHAVER, a University of Nebraska–Lincoln assistant professor located at the West Central Research and Extension Center (WCREC) in North Platte, Neb., specializes in nutrient management so that Nebraska soils efficiently produce crops for years to come.

To increase productivity, Shaver looks at new ways to use fertilizers and nutrients. He also looks at the relationships between soil and water and how they affect crop growth.

Plants need nitrogen, phosphorus, and potassium to grow. Since nitrogen is the fertilizer that is most used by plants, Shaver's research focuses on careful application of nitrogen so it does not leach into the groundwater.

"Nitrogen is interesting because it's highly water-soluble. So, wherever water goes, nitrogen is going to go with it," Shaver said.

Shaver's research is conducted in the area that overlies the deepest part of the High Plains Aquifer, often called the Ogallala Aquifer. The aquifer provides water for people, animals and crops, so researchers constantly monitor its quality.

The Ogallala Aquifer provides irrigation water to crops when precipitation does not fall from the sky.

Irrigation is a good way to supplement the amount of water needed to grow crops, Shaver said. "But it's also a finite resource, so we don't want to overuse it," he added.

Since there is less precipitation in the western part of Nebraska than in the east, the aquifer is beneficial to farmers, he said.

Soils in Nebraska vary greatly from the west to the east, but they also can vary within individual fields. Shaver's precision agriculture research at the West Central Research and Extension Center studies soil variability in the test fields and manages the crops based on those differences. Precision agriculture research determines the water and nutrients necessary for different soil types, increasing efficiency.

Landscape also determines how efficient an acre of land can be. In Brule, Neb., Shaver and his team are con-

ducting research to determine whether the slope of the land affects nutrients.

To help determine the effects, Shaver is using remote sensing technology, which is able to gather specific information about crops without having researchers come into contact with it.

Increasing the efficiency of nutrients and water gives farmers the ability to grow crops while using less water and fertilizer, Shaver said, increasing crop yields to help feed the world.

EXTENSION AND OUTREACH TO FARMERS

The 2012 drought experienced in Nebraska and in much of the U.S. reduced productivity for agricultural producers, but Shaver said that the drought helped him discover better ways to manage crops.

Shaver studies how drought-resistant crop hybrids fare under different water conditions. If the crops survive with little water and are just as productive, those research results would be beneficial to farmers.

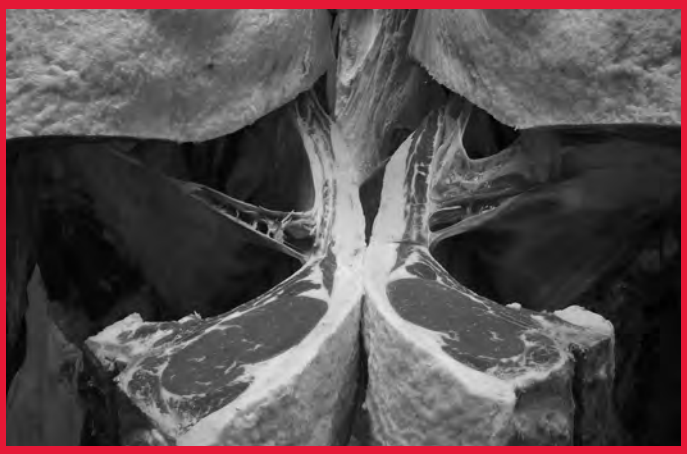
The length of time it takes for desirable results to be found in a research project varies from project to project. Some desirable results might take a few years before becoming available to farmers.

Once a method that will help increase crop efficiency is determined, the turnover rate is quick, Shaver said. Farmers would be able to incorporate the methods from the research into their fields improving their crop yields.

HEALTH and safety

Our overall mission is to improve the health of animals and humans.

Dr. David Hardin
Director
University of Nebraska–Lincoln
School of Veterinary Medicine and Biomedical Sciences



E. coli RESEARCH TEAM REDUCING outbreaks, educating public

by Mary Garbacz

Based on an interview by Monica Casey

VIDEO

Escherichia coli, or E. coli, are bacteria that can make people sick. Not all E. coli bacteria are harmful, but some can be deadly.

STEC

Managing the Risk of Shiga Toxin-Producing *Escherichia coli* in Beef

A MULTI-STATE research team of 50 collaborators from 12 institutions was awarded a five-year $25 million Coordinated Agricultural Project (CAP) grant, funded by the USDA National Institute of Food and Agriculture (NIFA). The work began in January 2012 with the goal of reducing the occurrence and public health risk from Shiga toxin-producing *E. coli* (STEC).

The research team has made progress in understanding the bacteria, including its detection and transmission, as well as in methods of educating the public about consumer responsibility.

One of the team's first accomplishments was to develop a website for public information (*stecbeefsafety.org*), as well as a Facebook page *facebook.com/stecbeefsafety*) to connect the public with information about the bacteria and information about the ongoing research.

Dr. Rod Moxley is the project director. Moxley is a veterinary pathologist and microbiologist, and a professor in the University of Nebraska–Lincoln School of Veterinary Medicine and Biomedical Sciences. The rest of the research team is comprised of: other veterinary microbiologists; food microbiologists; food scientists; clinical and extension veterinarians; extension food safety specialists; meat extension specialists; meat scientists; consumer scientists; animal scientists; molecular biologists; biochemists; physical chemists; agricultural economists; agricultural educators; biosystems, chemical and civil engineers; and veterinary epidemiologists. A civil engineer and

one veterinary epidemiologist are specialists in risk analysis and risk models.

"The foundation of our grant is quantitative microbial risk assessment — QMRA — and our specialists in this area are leaders in the development of risk models," he said. "They will take our data and through development of appropriate models, estimate the risk of becoming infected depending on different circumstances."

Moxley added that most members of the research team identify themselves as food safety specialists.

"The grant has five objectives and involves Shiga toxin-producing *E. coli* in beef, all the way from cattle to the consumer and in between," Moxley said. The objectives are:

- Development, improvement and validation of detection methods
- Biology, ecology and epidemiology of STEC organisms across the beef chain
- Intervention development (pre-harvest and post-harvest of animals)
- Quantitative microbial risk assessment model development
- Education and outreach

Reducing the public health risk of STEC to the consumer includes targeting the bacteria in cattle, in the environment and in beef processing, but also teaching consumers steps they can take at home to reduce the risk of infection.

"One individual on the team is a food safety scientist that specializes in the use of social media to deliver food safety messages. This individual developed barfblog: *barfblog.foodsafety.ksu.edu/barfblog* in which he uses shock language to get the attention of people, especially youth, and it is updated daily, literally by the minute," Moxley said. "It is out there for people to get comprehensive information about food safety issues that are going on in the world; it also allows for people to interact."

UNDERSTANDING STEC

The Shiga toxin-producing *E. coli* organisms are highly infectious and can be easily transmitted, Moxley said, adding that it takes very few organisms to transmit the disease.

People can become ill as a result of infection with Shiga toxin-producing *E. coli* through direct contact with animals that are shedding the organisms (including those at petting zoos); contaminated environments (including institutional settings and day care centers); water (including swimming pools and lakes); direct human-to-human contact; consumption of contaminated meat products; or consumption of contaminated fresh produce. *E. coli* is an important human health risk, Moxley said; a risk that the STEC research team is committed to reducing.

"*E. coli* is a bacterium, and we normally have non-pathogenic strains of it in our intestines," Moxley said. "It's also normally present in the environment and in the intestines and feces of animals." However, pathogenic strains have evolved, many of which acquired genes from other bacteria and phage (viruses), and these genes encode for proteins that cause disease.

"Shiga toxin is a protein toxin, or poison, the bacteria make that causes most of the disease manifestations in humans," Moxley explained. Those manifestations mainly include blood vessel damage, most often in the colon with resultant hemorrhagic colitis — bloody diarrhea — which also creates a risk of human-to-human transmission of the bacteria. A subset of these patients may further succumb to blood vessel damage in the kidneys, and suffer a life-threatening sequela, or aftereffect of disease, known as hemolytic uremic syndrome.

STEC bacteria are predominantly carried by ruminant animals, including cattle, sheep, deer and goats, Moxley said. These organisms colonize the intestinal tracts of ruminants. The bacteria may be spread secondarily by birds, flies and other insects and, although the bacteria pass through the gut in these species, they do not colonize to the extent they do in ruminants.

"The risk is always there for very serious illness with this organism," Moxley said. "People can die from it and when they do, it's most often due to kidney failure." Young children and the elderly are most likely to suffer the most serious consequences from an *E. coli* infection, he added.

Seven different types of Shiga toxin-producing *E. coli* (STEC) have been declared adulterants in non-intact, raw beef by the USDA Food Safety and Inspection Service (FSIS), Moxley said, and these are the focus of the CAP grant. *E. coli* O157:H7 was the first STEC to be declared an adulterant in 1994, and the other six non-O157 STEC types were declared adulterants in 2011. Seventy-one percent of the STEC cases in the United States are due to these six non-O157 types. The USDA has begun a testing program in an attempt to detect contaminated non-intact raw beef and prevent it from entering the food chain, Moxley said. If the raw beef product can be kept out of the food chain, Moxley said he would anticipate approximately a 50 percent reduction in the cases of STEC infections in humans.

An eighth type of STEC, O104:H4, was added to the team's research responsibilities by the USDA following a 2011 outbreak in Germany that sickened 4,000 people and resulted in 50 deaths from kidney failure. That newly emergent strain was thought to be attributable to fenugreek sprouts, but this was never proven, Moxley said. Preliminary studies so far suggest that this eighth *E. coli* type is not present in cattle. A specialist in detection methods, Moxley wants to be sure the testing has been appropriate and the results are reliable. Testing using more sensitive and optimized detection methods will be conducted to be completely certain the strain is not found in cattle.

Moxley said that fresh produce can be contaminated with STEC from contaminated water or soil, or spread by people who handle the food products. It also can be spread by flies or by wind-blown dirt. Additionally, wild pigs like to feed in fresh produce fields, and the pigs may have come from neighboring cattle farms or may have been drinking from streams that were contaminated by runoff — and then they spread it into the fresh produce. In some cases, the bacteria can go internally into the plant tissue, so it is impossible to wash off, Moxley said.

REDUCING INFECTIONS

Moxley said both pre-harvest and post-harvest methods are included in the USDA-NIFA grant in an effort to reduce *E. coli* infections and assure an ever-safer food supply. Pre-harvest management strategies in feedlots include feeding cattle food-grade microbes, like *Lactobacillus*, as a probiotic, he explained; research has shown that some *Lactobacillus* strains can reduce O157:H7 in cattle by maybe 35 percent, Moxley said.

Another strategy that is used is treating the hides of live animals with bacteriophage, which are natural viruses that infect and destroy the *E. coli* bacteria, Moxley said. These hide treatments are used at the abattoir before the animal is harvested. At harvest, additional interventions are typically used; for example, the carcasses of the animals may be washed with hot water and in many cases treated with approved antimicrobial compounds and steam pasteurized.

Another technique for reducing *E. coli* is to irradiate food and packaging with approved sources, such as cobalt-60 and electron beams, Moxley said. Irradiation of food and packaging is used to control spoilage and to eliminate foodborne pathogens and, similar to heat pasteurization, kills bacteria. Moxley said the Food and Drug Administration (FDA) has approved a number of foods for irradiation, such as fresh fruits and vegetables, beef, pork, poultry, spice, seasonings and a number of other foods. The FDA requires that irradiated foods bear the international symbol for irradiation. Although irradiation can be used to effectively eliminate foodborne pathogens, it does not prevent a consumer from re-contaminating the food product once the

package has been opened. For example, a person could have been handling raw meat, then move to salad preparation without thorough hand-washing.

"Secondary contamination from raw to cooked just defeats the whole purpose of irradiation and proper cooking," he said.

CONSUMER RESPONSIBILITY IN REDUCING STEC

Although Moxley and the rest of the STEC research team are hopeful that STEC can be significantly reduced through project efforts, they have to be realistic, he said. A shared responsibility for reducing Shiga toxin-producing *E. coli* bacterial infections lies in the hands of consumers.

Consumers need to be aware that raw products, including fresh produce and undercooked meat, could contain STEC organisms, Moxley said. The human eye cannot see microorganisms like STEC, so is difficult to know whether produce is contaminated, but with meat products, consumers can reduce the chance of infection through proper handling and cooking methods.

CONSUMER TIPS

- Wash hands and fingernails thoroughly, with soap and hot water, for 20-30 seconds before preparing food; after handling raw meat products; after using the bathroom; and after contact with a sick person.
- Children who visit petting zoos and pet the goats or other ruminant animals should wash their hands very well after the experience.
- Thoroughly wash food preparation areas (e.g., countertops, cutting boards), servingware and utensils before use.
- Cook ground meat products to at least 160 degrees Fahrenheit. Whole meats should be cooked to at least 145 degrees Fahrenheit, and allow to rest at least 3 minutes thereafter. Poultry (whole and ground) should be cooked to at least 165 degrees Fahrenheit. Check the temperature with a meat thermometer before serving the product.
- Keep food hot (at 140 degrees Fahrenheit or above) after cooking.
- Don't put cooked meat products back on a plate that held raw meat products.
- Completely thaw meat and poultry before cooking so it cooks more evenly. Thaw meat and poultry in the refrigerator, or in sealed packages in cold water. Alternatively, meats and poultry can be defrosted in a microwave oven if cooked immediately thereafter.
- Wash fresh produce thoroughly before eating.
- Refrigerate foods that will spoil, and keep your refrigerator below 40 degrees Fahrenheit. Meat and poultry should be refrigerated immediately upon arrival at home from the store. Freeze poultry and ground meat that won't be used in 1 or 2 days, and freeze other meat within 4 to 5 days.
- Don't feed raw meat to pets; they also are susceptible to many foodborne pathogens, so their food should be cooked.

POWERHOUSE RESEARCH:
School of Veterinary Medicine and Biomedical Sciences

by Jasmine Rogers

VIDEO

It is an unremarkable building on the University of Nebraska–Lincoln East Campus, but the remarkable research conducted inside makes life better for both humans and animals.

WORK AT THE UNL School of Veterinary Medicine and Biomedical Sciences is focused on animal and human disease, said Dr. David Hardin, director of the school and associate dean of the professional program in veterinary medicine.

"We serve the citizens of Nebraska and the greater world," Dr. Hardin said. "Since we are a Veterinary Medicine and Biomedical Sciences unit, we focus on animal and human health issues. Our work ranges from the development of new knowledge that enhances our understanding of the mechanisms that cause disease to the development of diagnostic tests, treatments and prevention strategies. We serve animals and people in a number of ways, from our pet populations to the safety of our food supply.

"Our overall mission is to improve the health of animals and humans," Dr. Hardin said.

"It's important to maintain healthy people and healthy animals — they go hand in hand," he said. Many of the diseases have the potential to spread from animals to people and people to animals, so understanding both human and animal diseases have a positive effect on both, he said. This concept is commonly referred to as "One Health."

The better we can understand disease processes,

including how diseases spread among populations of people and animals, the better they can put practices and procedures in place to prevent them, he said. Those practices can be as simple as handwashing to prevent the spread of influenza, to as complicated as strict quarantine of sick animals.

TEACHING, RESEARCH, OUTREACH/SERVICE

A three-pronged approach helps the school's staff of veterinarians, animal scientists and food safety specialists to ensure animal health and a safe food supply. The land-grant mission of the University of Nebraska consists of teaching, research and outreach, or service, Dr. Hardin said. The School of Veterinary Medicine and Biomedical Sciences represents all three.

Teaching

"We are teaching students at the undergraduate, graduate and professional levels," he said, "and helping them understand biomedical principles and disease processes."

Undergraduate students may have careers in pharmaceutical or other industries that support animal and human health; graduate students are trained to be the next generation of research scientists, and veterinary students are trained to go out and serve companion animals and food-producing animals.

The UNL School of Veterinary Medicine and Biomedical Sciences has partnered with the Iowa State University College of Veterinary Medicine since 2007 to train future veterinarians in what is called a Two Plus Two (2+2) Agreement.

Students from UNL complete their first two years of veterinary school at UNL and their last two at ISU to receive the Doctor of Veterinary Medicine degree. The degree is granted from Iowa State, Dr. Hardin said.

The UNL students complete two years of basic sciences training at UNL, and then the last two years of the curriculum is more clinical, during which students actually work in the teaching hospital. While in the teaching hospital the students rotate through a number of specialty areas such as surgery, dermatology, oncology, neurology, reproduction, food animal medicine and equine medicine, Dr. Hardin said.

The UNL School of Veterinary Medicine and Biomedical Sciences also provides clinical training for 3rd and 4th year veterinary students at the Great Plains Veterinary Educational Center (GPVEC) located at Clay Center, Neb. Located on the grounds of the UDSA Meat Animal Research Center (USMARC), the GPVEC utilizes the animals at USMARC to train veterinary students in food animal medicine and production management.

> ***"We serve the citizens** of Nebraska and the greater world," Hardin said. "Since we are a Veterinary Medical and Biomedical Sciences unit, we focus on animal and human health issues."*
>
> *— Dr. David Hardin*

"We work alongside the scientist and animal caretakers at USMARC to care for the animals on the center. This provides unique teaching opportunities and hands-on experience for students," he said.

The Veterinary Diagnostic Center, while its focus is on diagnosing disease, also has an educational component, which is helping people to understand the value of diagnosing the diseases, Dr. Hardin said.

Research

"We're doing extensive research in a number of diseases that affect animals," he said, including a respiratory disease in cattle caused by the herpes virus; the porcine reproductive and respiratory syndrome (PRRS) virus in swine; and *E. coli* research, funded by a $25 million, multi-institution USDA grant to reduce *E. coli* and continually improve the safety of the food supply.

Many of the scientists in the School of Veterinary Medicine and Biomedical Sciences are doing extensive research to better understand the causes of human disease, such as autoimmune disease that contributes to heart disease and to Parkinson's disease, Dr. Hardin said.

Outreach/Service: Veterinary Diagnostic Center

"Our veterinary diagnostic center is focused on diagnostic medicine and diagnosing diseases," he said. "We do testing for the regulatory diseases that are required

for import and export of products. This testing serves to safeguard the state's and the nation's ability to trade internationally," he added.

The Veterinary Diagnostic Center is a part of a national system of diagnostic centers that work together to diagnose disease and determine locations of outbreaks. The center also works with the Nebraska Department of Agriculture, Nebraska Department of Human and Health Services and Nebraska Game and Parks to conduct disease surveillance designs to protect human and animal health.

Safeguarding both animal and human health is important, Dr. Hardin said.

"For us to prevent disease, we have to understand disease, first and foremost. If a sickness occurs, you need to understand what's causing the sickness."

For a veterinarian or a physician, a physical exam begins the process, followed by diagnostic tests. Offer blood or other body fluids are submitted to diagnostic laboratories. The Nebraska Veterinary Diagnostic Center can run a number of microbiological tests to identify viruses, bacteria, protozoa and parasites, Dr. Hardin said, while the center's pathologists look at tissue samples to determine the presence of disease conditions. For example, the NVDC pathologists are asked to examine tissues to determine if the animal has cancer.

Cutting-edge, sensitive technologies such as DNA sequencing and molecular diagnostics are opening new frontiers in diagnostic medicine and speed test results, enabling faster and more effective treatments.

NEW TECHNOLOGIES REQUIRE NEW FACILITIES

Those new, cutting-edge technologies have expanded the Veterinary Diagnostic Center's capabilities and better serve animal well-being, but the facility, built in 1975, was not designed to accommodate the new technology, equipment, and the advancement in biosecurity requirements.

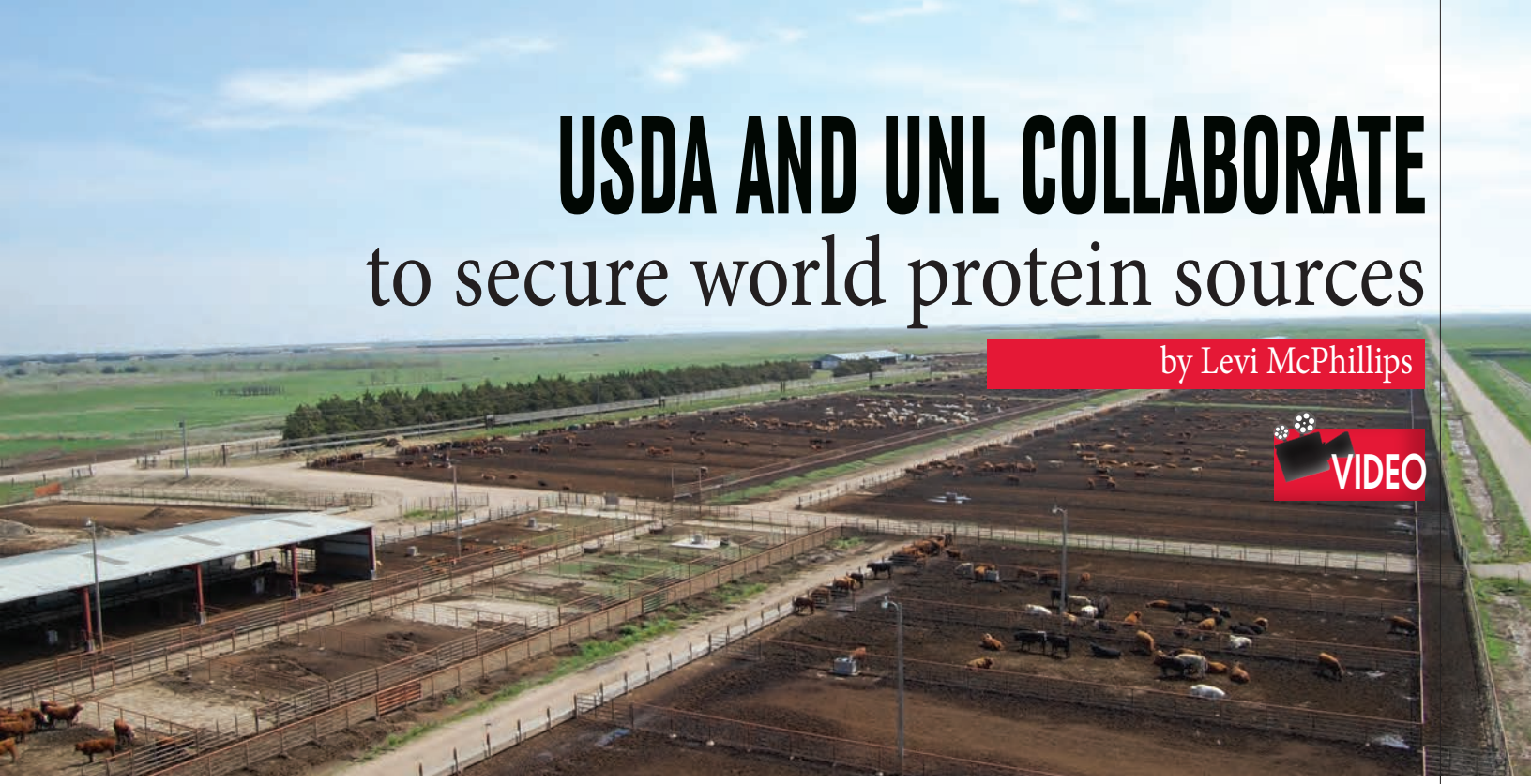
"We are very crowded in the veterinary diagnostic laboratory, and this presents some real challenges that are beginning to limit our abilities to keep pace with modern diagnostics. So far, we have been able to address the facilities challenges; however, a new laboratory is critical if the VDC is to keep pace with emerging technology and diagnostic methods," Dr. Hardin said.

Ronnie Green, Institute of Agriculture and Natural Resources (IANR) Harlan vice chancellor and University of Nebraska vice president for agriculture and natural resources, currently is leading the effort to raise funds for a new Veterinary Diagnostic Center.

For more information about the School of Veterinary Medicine and Biomedical Sciences, as well as the Veterinary Diagnostic Center, visit: *vbms.unl.edu*

"For us to prevent disease, *we have to understand disease, first and foremost. If a sickness occurs, you need to understand what's causing the sickness."*

— Dr. David Hardin



USDA AND UNL COLLABORATE to secure world protein sources

by Levi McPhillips

VIDEO

Big problems are being solved every day at the Roman L. Hruska U.S. Meat Animal Research Center (USMARC) near Clay Center, Neb. Big problems like E. coli *and salmonella that can make people sick, and diseases that make animals sick, like Bovine Respiratory Disease.*

THE PEOPLE working on these big problems are conducting their research on an expanse of land that was once a naval munitions depot during WWII. The area was converted into a livestock and crop operation with the accommodations needed to investigate the biggest challenges in meat animal production.

John Pollak is the Director of USMARC. He says he believes in the importance of the research at the center, and scientific advances will need to be made to feed the world in the future.

"Most people are (aware) of the impending growth in the population and the issues in feeding that population in 2050 with twice as much food and not much new land," Pollak noted. "The research enterprises like the Meat Animal Research Center and University of Nebraska are treasures that we need to make sure are sustained."

The U.S. Meat Animal Research Center is located three miles south and 15 miles east of Hastings, Neb., and is a large employer located near the small rural community of Clay Center. Both federal and University of Nebraska–Lincoln employees staff the USMARC, Pollak said. Forty-eight are U.S. Department of Agriculture Agricultural Research Service scientists; 100 UNL employees operate the farming and animal production operations on the 34,000-acre federal facility. Fifty-two of the remaining employees are lab technicians, people who work in the business office and computer facilities and administrative workers.

SCOPE OF PRODUCTION, RESEARCH

"We graze 22,000 of those acres. We farm about 2,600 acres of corn and have a couple of pivots of soybeans," Pollak said. "We produce hay off of about 1,800 irrigated acres and have about 1,800 acres of irrigated pastures," he added. In addition, there are thousands of head of cattle, sheep and pigs at the center that eat the crops produced on the land.

Because of the experimental mission of USMARC, Pollak said, it isn't an option to decrease animal populations when drought makes feed supplies scarce, so there

According to Pollak, *E. coli bacteria are everywhere. However, not every kind of E. coli is dangerous to humans. The scientists at USMARC are studying the DNA of E. coli to better understand them.*

must be enough feed produced to support the animal population. The 6,772 breeding female cattle at the research center are studied extensively. In addition, the feedlot has a capacity of 6,000 cattle, and the number of cattle being studied in the feedlot will vary depending on the time of year, Pollak said.

The Agricultural Research Service (ARS) is the U.S. Department of Agriculture's scientific research agency, with more than 90 research facilities in the U.S. and overseas. The USMARC facility is one of two ARS facilities in Nebraska; the other is at the University of Nebraska–Lincoln.

Roman L. Hruska, for whom the facility is named, served as a U.S. Representative from Nebraska from 1953 until 1954, when he was elected to the U.S. Senate. Hruska served in the U.S. Senate from 1954 until 1976. Hruska lobbied for the site of the munitions depot to be turned over to the USDA, resulting in the facility's location there in 1964.

FOOD SAFETY

The food safety research at USMARC is conducted by USDA microbiologists, Pollak said, mainly focusing on *E. coli* O157.

"That's the one that for many decades was an instigator of health issues associated with *E. coli* O157," he said. Salmonella research also is conducted at USMARC; the *E. coli* O157 and salmonella research have been two "flagship" programs, Pollak added. In 2012, the USDA Food Safety and Inspection Service (FSIS) mandated testing for an additional six *E. coli* strains, and USMARC researchers already have directed a great deal of attention to these six strains, he said.

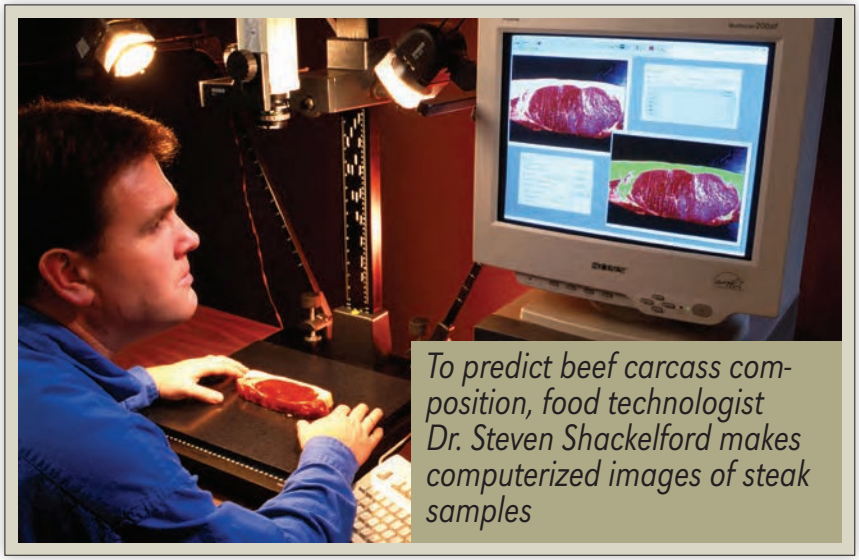
According to Pollak, *E. coli* bacteria are everywhere. However, not every kind of *E. coli* is dangerous to humans. The scientists at USMARC are studying the DNA of *E. coli* to better understand them.

"Because we have a very large genomics program at the Meat Animal Research Center, a very large effort that we have in food safety is actually sequencing the genomes of these pathogens," Pollak said. Sequencing DNA means that the genetic information is decoded, and scientists do this to better understand which parts of their DNA make them unique. Having a greater understanding of *E. coli* DNA will help researchers prevent the spread of *E. coli* into the food supply.

Work at the Meat Animal Research Center, Pollak said, involves both pre-harvest and post-harvest studies. In pre-harvest studies, research is conducted in feedlot settings, looking at how *E. coli* moves from animal to animal.

According to Pollak, some cattle get colonized by *E. coli* O157. These cattle are referred to as "super shedders." These animals "shed" the bacteria through their feces. The bacteria get on the hides of these animals, and the *E. coli* spreads to the other cattle in the pen. The animals that shed the pathogen are still safe to consume, but they increase the risk of getting *E. coli* O157 on other animals and on cattle processing facilities.

"(Our researchers are) looking at the physiology and genetics of the animals that are 'high shedders' to see if we can identify them and eliminate them from the feedlot environment in such a way that that contamination doesn't occur," Pollak said.



To predict beef carcass composition, food technologist Dr. Steven Shackelford makes computerized images of steak samples

Other research is done from the point of slaughter to final processing, Pollak said.

"From the point of slaughter to final processing is where we focus much of our efforts, although we also look at strategies for sampling product to test for pathogens," he explained. These studies, Pollak said, look at the washing of hides, the washing of carcasses, and how the bacteria can be spread during meat processing.

WATER TREATMENT

When the current USMARC property was still a munitions depot, the underground water in the aquifer was contaminated, Pollak said.

A project has begun in which a new water treatment facility built by the Army Corps of Engineers is treating the contaminated water, he said. After treatment, the water will be safe to use and will help supply the various parts of the center. Some of that water will naturally recharge the underground aquifer. Other water from the facility will be used to irrigate the center's agricultural land, Pollak said.

ANIMAL HEALTH — BOVINE RESPIRATORY DISEASE (BRD)

A new area of study has the potential, according to Pollak, to improve how livestock producers manage the health of their animals. Sequencing the DNA of livestock species and the DNA of common disease pathogens will help livestock producers identify animals that are more susceptible to disease.

"(We are) trying to decide how we can use knowledge of the genomes of the organism itself to mitigate some of the health issues that we see by knowing better how to handle it and prevent outbreaks," Pollak said. They are also looking at the genomes of the host to see if there is an interaction between the genetics of the animal and the genetics of the organism.

One of the diseases being studied is BRD (Bovine Respiratory Disease) which has symptoms similar to pneumonia. Cattle infected with BRD will have lower performance and can spread the disease to other cattle, Pollak noted.

The effects of BRD are a high cost to the feedlot industry. Researchers are trying to use the genomic information of the cattle and the genomic information of the disease organisms to prevent the disease.

"We are heavily invested in genomics. Genomics has been around for quite some time, but it is just now starting to deliver some very valuable tools to the industry. We need to keep working in that direction, not necessarily for just the selection that you can do based on genetic markers, but also finding out ways in which knowing something about the genetic profile of an animal we can manage it better," Pollak said.

The research at USMARC is publicly funded, and Pollak said he wants taxpayers to know the value of agricultural research and its role in securing a safe and adequate food supply.

"I think it's very important that people understand the importance of publicly funded research," Pollak noted. "I think all too often when you see industries that start to abandon their research enterprise, it is just a matter of time before the technologies that are needed to be delivered stop getting delivered and lead to issues."

Pollak said the research being conducted at USMARC is needed to sustain an adequate food supply for future generations.

"The future of the world is dependent on us increasing food production, and we believe that animals will be an important part of that," Pollak said. "We hope that is our contribution to the future generations in terms of providing good protein sources for them in an efficient manner such that animal production can be sustainable."

FOOD SAFETY RESEARCH
extension benefits the world

by Mary Garbacz

VIDEO

Based on an interview by Monica Casey

Call it a team approach, a systems approach or just working together. Whatever it's called, food safety researchers at the University of Nebraska–Lincoln and throughout the U.S. have had enormous impact not only in the United States, but worldwide.

"THE (U.S.) Centers for Disease Control (CDC) came out with a report in 2012, indicating that we have made a 40 percent reduction in foodborne illnesses since 1999," said Dennis Burson, UNL extension meat and food safety specialist.

Foodborne illness is caused by a variety of bacteria. Symptoms of foodborne illness may be mild, or they may be serious — even deadly. University of Nebraska–Lincoln Extension specialists and researchers have teamed with specialists in universities, and state and national organizations to fight the causes of foodborne illness to create an ever-safer world food supply.

Reduction in foodborne illness has been a primary driver in many food industries. Most food industries place food safety as one of their highest company priorities and as a result of that, they need assistance and information to solve existing or future problems, Burson said.

HACCP

Burson teaches workshops and UNL classes in Hazard Analysis and Critical Control Points (HAACP), which is a process to control food safety issues, he said. The HACCP process is the best approach available to any one of the food safety issues today, he added.

The USDA implemented HACCP in 1998 and the Food and Drug Administration (FDA) just published the Food Safety Modernization Act Rules, which include aspects of HACCP, he said. There also is the Global Food Safety Initiative, which includes the support of large, global retail operations.

"All of these have contributed to a requirement that individuals know and understand the HACCP system and can apply it in a production facility," Burson said, so employee training is a large component of integrating the plan.

Burson is a faculty member in the UNL Department of Animal Science and also has a courtesy faculty appointment in the UNL Department of Food Science and Technology, where he teaches a Quality Assurance class. Part of that class is focused on HACCP and ties directly into programs he teaches through his extension appointment, he said.

Teaching people in the food industry and also teaching UNL students is a "nice association," Burson said; he can provide real-time, real-life stories to students in the classroom and challenge them to think like industry professionals, which some UNL students eventually will be.

"The application of HACCP does require a good understanding of how the industry operates, especially in terms of a processing system for any meat or food product," he said.

MEAT PROCESSORS

Nebraska is known for raising and processing beef cattle. Burson said he and other UNL food safety specialists work with any meat processor that needs help at the time, in Nebraska and nationally.

"Small processors are especially concerned about meat quality; they sell locally and if their food is not of high-enough quality, everybody in town knows about it. It's a local item and a local food," Burson said. For example, *Listeria monocytogenes* is a foodborne bacteria that affects ready-to-eat foods such as ham, sliced deli meats and hotdogs. It is especially a concern for pregnant women, infants and

the elderly. Burson's research into strategies to control these bacteria involved adding appropriate levels of sodium lactate and sodium diacetate — basically just vinegar — to the meat products.

"It actually enhanced flavors of the products and plus, it made the products safer because the organic acid salts are very good at inhibiting the growth of *Listeria monocytogenes*," Burson said.

SUCCESSES

Pathogenic (or Shiga toxin-producing) *Escherichia coli* (*E. coli*) is one of the biggest culprits in the beef industry in terms of foodborne illness, Burson said, and in 1993, one strain of the bacteria — *E. coli* O157:H7 — was the one everybody was trying to figure out how to address.

They did.

"The beef industry should be proud. Because of their efforts, there's been a 42 percent reduction in the number of illnesses from *E. coli* O157:H7 from 1998 to 2011," Burson said. "We've made progress."

Burson said when research began into *E. coli* O157:H7, the focus was entirely on ground beef and the beef industry.

"We haven't had one multi-state outbreak of *E. coli* O157:H7 associated with ground beef in a number of years," he said. He pointed out that in very recent years, all of the illnesses from *E. coli* O157:H7 have occurred in other food items. The CDC, which tracks outbreaks related to all foods and their origins, recently sent out a news release identifying leafy green vegetables as more of a concern than beef or other meat items, Burson said.

"So, these are things that we're proud of — that we contribute to on a national basis and to the changes that have happened in the food safety system here in the United States," he said.

But the work continues, he said; the U.S. Department of Health and Human Services, Healthy People 2020 has set a goal of another 50 percent reduction in foodborne illness from *E. coli* O157:H7. Burson said that by 2020, the goal is to have fewer than 0.6 foodborne illnesses per 100,000 people.

SPREADING THE NEWS

Burson said he and his colleagues nationally publish research results in scientific journals that are peer-reviewed, which means other scientists have looked at the research to be sure it has been conducted correctly and that the results are valid. The Journal of Food Protection publishes many of

their findings; Burson and his food safety colleagues also publish in local publications and take abstracts to scientific meetings.

UNL RESEARCH

Research at UNL also has included the food safety impact from the pre-harvest side, which involves the livestock producer or feedlot operator. Burson said only one other university has a similar program.

The University of Nebraska–Lincoln also was successful in obtaining a $25 million multi-institution USDA-NIFA grant to study *E. coli*, particularly the Shiga toxin-producing (STEC) strains.

The USDA has identified six types of STECs that they have declared adulterants in food, Burson said. Researchers at UNL are leading the USDA-NIFA research project and will produce risk assessment recommendations that food processors can use to reduce foodborne illness due to those STECs, he added.

"Nebraska sits here as a beef industry with all the resources. We have the cow-calf operations; we have the feeders; we have the feedlot industry; we have the processing industry; and we have the food processing industry, all right here in Nebraska," he said. "We've developed strong relationships for each of those segments with the faculty at the university — I think that is one of the strengths that we have here in Nebraska."

METHANE
and sustainability agriculture

by Jasmine Rogers

VIDEO

Samodha Fernando, a molecular microbiologist and assistant professor of animal science at the University of Nebraska–Lincoln, studies ruminant animals, such as cattle, to increase the animals' performance by manipulating the gut microbial community. To do this, he and his research team are specifically looking at the microbes that reside within the rumen.

FERNANDO WORKS with UNL specialists Terry Klopfenstein, Galen Erickson, James MacDonald, Rick Rasby, Matthew Luebbe and Karla Jenkins to help improve the feed efficiency of beef animals, the safety of beef and the sustainability of cattle production.

The rumen is a four-chambered stomach that allows the ruminant animal to digest cellulose-rich diets such as grass and other forages. The microbes that are present within the four-chambered stomach are breaking down the diet through fermentation to provide energy to the animal, Fernando said. Fernando describes the rumen as a complex ecosystem that is mainly composed of bacteria, viruses, protozoa and fungi that work together.

"We are actually looking at the whole beef production system to see how we can increase performance," he said. By looking at the whole system, he and his colleagues can look at food safety, greenhouse gas (GHG) emissions and other production elements, in addition to animal performance.

Cattle are considered one of the major sources of anthropogenic methane production. Within the rumen, a group of bacteria known as methanogens produce methane mainly by combining carbon dioxide and hydrogen produced during fermentation, Fernando said. When an animal releases methane, it also is releasing energy that could

have been used by the animal as energy.

REDUCING METHANE, INCREASING PERFORMANCE

"What we are trying to do in our research is really looking at how can we reduce the methane emissions so that we can reduce GHG emissions," Fernando said. "But at the same time, we are increasing the performance of the animal because we are trying to retain more carbon inside the animal."

"The way we are trying to do this is to control the methane-producing population in the rumen using diet," Fernando said.

There are ways to reduce methane in cattle by looking at the interactions between diet, methane production and the rumen microbes, Fernando said. If he and his team can identify dietary factors that influence the methane-producing microbial community, they can use the diet to control methanogens and increase animal performance. However, there is a delicate balance between microbes and the diet, Fernando said.

"We are trying to understand how rumen microbes can be manipulated under different dietary conditions, or different environmental conditions, to improve animal performance by really understanding microbial processes," Fernando said.

Fernando and his research team conduct basic research, such as identifying the kinds of microbes in the rumen, their functions, how they produce energy under different dietary conditions and how the microbial community interacts with each other.

BIG SUCCESS IN A SMALL MICROBIAL WORLD

Fernando has been a faculty member at UNL since 2011. His team has a $749,920 USDA-NIFA (National Institute of Food and Agriculture) grant to study how to reduce methane emission in cattle. It is a four-year project and during the fourth year, UNL will hold a conference to discuss methane research.

Fernando and his team also have secured funding from the National Cattlemen's Association and the Nebraska Beef Council to further their research in reducing Shiga toxin-producing *E. coli* shedding in cattle.

BEEF bites

Cattle can digest plant materials that humans cannot, turning those materials into high-quality protein.

To do this, Fernando is looking at *E. coli* high-shedding and low-shedding cattle. Shedding is described as the number of pathogenic *E. coli* that are released through an animal's feces. High-shedding animals have a large number of pathogenic *E. coli* release through their feces, while low-shedding animals release a smaller number of pathogenic *E. coli*.

Since the world will be feeding nine billion by 2050, agriculture needs to be more efficient and sustainable. Fernando believes that the projects that he and his team are working on will be able to do both.

In the future, Fernando wants to further reduce methane emission caused by cattle, increase beef cattle productivity, and use methane as a source of sustainable agriculture.

In addition, Fernando wants to study the interactions between the microbiome and the host genotype. This would allow him to select the genotype of the animal and possibly help select for microbes that increase performance in cattle.

"If we can make the animals perform better with the same amount of diet and get more energy out of it, that means you can feed them less and reduce production costs, which is a huge benefit to the producer," he said.

SAFE FOOD SYSTEM
the result of science, monitoring

by Sydney Hansen

VIDEO

The United States historically has had the safest food supply in the world, and it's getting better all the time.

INCREASED scientific knowledge and monitoring of the food supply make it possible to find problems before anyone can become ill, said Amy Millmier Schmidt, assistant professor and livestock bioenvironmental engineer at the University of Nebraska–Lincoln.

Media focus also has increased, Schmidt said.

"Years ago, we probably had a lot more incidences of foodborne illness, but the media wasn't sharing it as much," she said. Publicity over food recalls attracts public attention, "but really, we're finding it out a lot sooner — before someone actually gets sick from it," she said.

MANURE MANAGEMENT, FOOD SAFETY

Schmidt works with manure and environmental management for livestock production systems, as well as with regulations that affect those systems, to help assure human health and food safety.

Her work looks at how producers manage the source of manure from livestock, anything from the excretion of the manure by the cattle, the nutrients and pathogens that the manure contains, the manure storage system and methods of safely using manure as fertilizer, she said. She also works with the regulations related to livestock systems and helps producers design or modify systems to comply with regulations.

In the past, manure has been viewed as a waste product that needed to be disposed of, but recently has gained more interest from farmers for its fertilizer value, she added.

"My research program is focused on looking at ways to minimize the environmental impact of manure management systems for livestock operations," Schmidt said. Included in her research are efforts to reduce nutrient and pathogen losses from excreted, stored and land-applied manure and making sure those compounds are controlled before reaching surface and groundwater, as well as reducing pathogen presence on crops that are grown for human consumption. The main nutrients in manure are nitrogen and phosphorus. These nutrients are essential for plant growth, but when these nutrients are lost to a water body, they increase the growth of aquatic plants. The result is algae blooms and fish kills, she said.

Phosphorus will not leach through the soil profile like nitrogen will, she said. When nitrogen gets into the groundwater, it can become an issue for human health when concentrations are high enough because when the water is consumed, it can reduce the oxygen-carrying capacity of the blood, affecting oxygen reaching vital organs.

"The one thing that is universal, regardless of whether you confine five head of cattle or five hundred, or five thousand, is that you can't release manure to waters of the state," Schmidt said. These regulations apply to animals in confined systems, like feedlots, but pasture-based systems have a responsibility for protecting water quality by keeping animals out of ponds and streams, as well. Waters of the state includes ponds, streams, and even ditches or waterways — anything with a direct connection to surface water. Manure runoff can be managed in one of several ways, she said. Feedlots can use runoff holding ponds that contain manure and stormwater until the material can be pumped and land-applied, or even a vegetative system in which feedlot runoff is pumped onto a growing crop and does not discharge into

waters, she explained. With vegetative treatment systems, feedlot runoff is held in a temporary storage basin and either manually or automatically irrigated to a growing field, she said. Other techniques that producers use are knifing manure into the soil or applying the manure on the surface, she added. The application of the manure cannot occur within a certain distance from drinking water sources, so producers have to follow regulations regarding their manure management, she explained.

REGULATIONS

Schmidt also specializes in the regulatory side of the livestock industry, working with federal, state and local regulatory agencies and helping producers to understand and comply with those regulations.

Large feedlot operations have to operate with a permit and must write and follow a nutrient management plan. Understanding the regulations that producers have to follow can be complicated.

"I think there's a real need to just break down those regulations and make them concise and easy to understand for the producers," Schmidt said. Her UNL Extension responsibilities include helping producers implement new manure management techniques and understand how to comply with regulations, she said.

"I think there's a real need to advocate for the producers when new regulations are being proposed," she said, adding that she does function in that role.

It also is important to know whether a new regulation is going to make a positive environmental impact, she added.

"One of the things that I hate to see is a regulation that's costly to implement and really does not have a great environmental impact," she said.

As part of her UNL Extension appointment, Schmidt works with a group called the Livestock and Environment Interest Group. This group is made up of people from the Nebraska Department of Environmental Quality, Natural Resources Conservation Service, UNL Extension and commodity groups such as Nebraska Cattlemen.

"The whole goal is to bring these individuals together on a quarterly basis and just talk about the issues that the livestock industry is facing," she said. This allows producers to have a voice and to share the difficulties that they are facing with specific regulations while at the same time giving the NDEQ a forum to discuss new rules from the perspective of the enforcement agency, she added. This group also helps generate new research ideas when producers share issues they are facing and also gives Schmidt the opportunity to educate producers on how to operate their systems in an environmentally safe way, she said.

"I take a lot of pride in going out and sharing information with producers that can help them be more sustainable in their operations and create a more economical system for them," Schmidt said.

For large feedlot operations, good environmental and manure management record-keeping is important.

"Record-keeping is not usually the most enjoyable part of the nutrient management process, but it can be a good insurance policy for the producers," Schmidt said. It is to the producer's advantage to follow regulations and maintain accurate records of activities; the Department of Environmental Quality schedules visits to check feedlot operations to make sure they are using correct manure-management techniques.

OBJECTIVE, COLLABORATIVE, INTERNATIONAL

Schmidt continually studies new ways to treat and handle manure to make sure it is environmentally safe, she said. This type of research is conducted at the University of Nebraska–Lincoln because there is such a large livestock industry in Nebraska, she said. Producers, UNL and USDA facilities collaborate to help solve various issues, she said.

"I think one of the things that's going to become a big issue or bigger issue is the food safety aspect and the human health aspect; I think a lot of the research is going to have to focus on how to make manure safer," Schmidt said.

"I think a lot of countries outside the United States turn to the land-grant universities here because they know that our information is research-based and so we have the opportunity to share that information outside of the country to help the management systems," Schmidt said. The research conducted in Nebraska can be implemented in systems within or outside of the United States, she said.

"UNL is a great place to work because there is a broad expertise of faculty and researchers who can look at all aspects of livestock production from the animal to the environment and the engineering side of manure storage and land application," Schmidt said.

AG POLICY ISSUES affect beef industry

by Sydney Hansen

VIDEO

Agricultural economics is front-and-center in the challenge of feeding nine billion people by 2050. Addressing that challenge involves work in policy, international trade, environmental protection, energy, consumer demands and social agendas.

NEBRASKA'S BEEF industry is integrated in all of those areas, according to Brad Lubben, University of Nebraska–Lincoln Extension assistant professor and policy specialist in the Department of Agricultural Economics. Lubben helps producers, students and public audiences understand policy and helps producers make better risk-management decisions.

"That's the challenge for agriculture; that's what we research, study and teach here at the university," he said.

As a policy specialist, Lubben's work includes studies of events that affect agriculture and how the industry responds, including legislation, trade policies and agreements — and more.

POLICY ISSUES, SOCIAL AGENDAS

"Think about all the policy issues and all the different arenas where those policy issues are affecting producers," he said, including all three branches of government — legislative, executive and judicial. The legislative branch may include the farm bill or trade agreements; the executive branch may include rules for the Environmental Protection Agency, enforcement of environmental regulations or proposed rules for a new food safety act — and how all of those rules affect the ag industry. The judicial branch, Lubben said, includes the court challenges that can result from new legislation.

"That's Civics 101," Lubben said, but added that more and more policy is being debated in the social arena.

"It's social movements that affect corporate decisions — think animal welfare, local foods, biotechnology. How many of those issues are being played out in interest groups and social media? What producers have to do to satisfy the supply chain requirements of major corporations might be a function of what interest groups have pushed in terms of a strategy to that corporation," Lubben explained.

The policy arena is wide and there has been a history of interest groups affecting policy, he said, but building policy in the social arena is a new experience.

"It clearly has policy ramifications in terms of expectations, demands and constraints on producers," he said. Nebraska and other state and national agriculture groups are building education campaigns to provide facts and support for agriculture, he added.

BEEF EXPORTS

"The beef industry is the most independent industry out there," said Lubben. Much of the policy debate is concerned with what is going to harm or constrain the industry, but there are policies that are supportive of the beef industry. In-

ternational trade policies allow beef products to go overseas where consumers also demand those products.

"Policies that help drive economic stability and growth are pretty critical to also driving global beef demand in the long run," Lubben said.

The beef sector in the United States has gone from being a net importer of beef to being a net exporter in terms of value, Lubben said, if not in volume. Trade agreements and increased trade flows help; the sector better serves consumers around the world, he said.

Value from the carcass

There are parts of the beef carcass, such as variety meats, for which there is a low demand among U.S. consumers, but for which there is a high demand in other countries. The trade discussion is about getting the highest possible total value out of the carcass, he said, and finding markets for every part of the carcass.

"If it wasn't for a trading system that allowed some of those products to go overseas where there is a higher demand, the value would be less, the cost of processing would be greater and that would show up in lower beef prices for producers," Lubben said.

Trade restrictions

Countries' regulations change frequently regarding imports of U.S. beef. When a country lifts its restrictions, it allows for more access and an increase in imports coming from the United States. Access to growing economies and markets is essential to the beef industry, he said. If it were not for trade policies, the value of beef would be lower, processing and production costs would be higher, and that would have an impact on producers and beef prices domestically, Lubben explained.

"Trade is about market growth and it's the trade agreements, it's the trade promotion that helps to establish and maintain those markets," Lubben said.

The Trans-Pacific Partnership (TPP) is the latest in potential trade negotiations that could result in a free trade agreement with Pacific Rim nations, Lubben said, that would improve global trading access. Some countries have imposed restrictions on imports of U.S. beef; if the TPP were to open access to Pacific Rim countries, Lubben's hope is that some of those restrictions would ease. Until early in 2013, Japan had age restrictions on beef imports, but the 2013 revision of those restrictions has created better trade access. Having more trade negotiations would do even more, Lubben said.

The U.S. and the European Union also are pursuing a trade agreement called the Transatlantic Trade and Investment Partnership (TTIP), he said. If it were to develop, it would tie together the two largest economic regions in the world. The European Union has a long-standing ban on beef imports from the United States, if that beef has been produced with hormones. Some U.S. beef now is being produced without hormones, so the U.S. now can move some that beef through a specialty supply chain and export it to the European Union. But, a new trade agreement could possibly expand beef exports to the European Union and much more, he said.

Exchange rates

Lubben studies the U.S. economy and the economies of other countries, as well as market volatility in each country. Individuals who watch financial markets are looking for signs that could impact exchange rates.

"Exchange rates matter because we're trying to sell beef to Japan, South Korea, other parts of Southeast Asia, Europe and elsewhere," Lubben said. If the U.S. economy is not performing well, that affects trade relationships, he said. The economies of other countries impact the demand for products produced by the U.S. Even though recent U.S. economic growth has been modest, Lubben said it still is among the strongest in the world, especially compared to countries suffering recessionary pressure.

"That impacts our potential export market demand, so policies that help drive economic stability and growth are critical to driving global beef demand in the long run," he added.

RISK MANAGEMENT

Lubben relies on communication from agricultural producers to learn about issues that are high-interest areas and areas of risk. That feedback helps to inform his areas of research and education.

"We have a substantial investment in the area of risk management education," he said, including the North Central Risk Management Education Center located in the UNL Department of Agricultural Economics. That center is funded through the USDA to provide grant funds that assist in delivery of education programs to producers. Knowing what risks producers face directly influences the grants and educational programs the center can support, Lubben said.

TY SCHMIDT, assistant professor of animal science at the University of Nebraska–Lincoln, works to improve meat quality, quantity and safety for the Nebraska beef industry through pre-harvest intervention strategies. All strategies work toward better quality, greater quantity and safe meat for consumers.

"Pre-harvest intervention is simply the evaluation of anything we can do to improve the quality of meat prior to harvest," Schmidt said.

Schmidt's work focuses on improvements to the quality grade, yield grade, or the safety of meat prior to harvest of the animal. He looks at pre-harvest strategies such as nutritional supplementation, animal health, animal physiology and management techniques that producers can use to improve the quality or quantity of beef products, thus allowing producers to increase their profitability.

TEMPERAMENT AFFECTS DISEASE, STRESS

An area of research that Schmidt focuses on currently is the temperament of cattle and how temperament can impact a wide range of production variables associated with cattle, from average daily gain to marbling score.

"Cattle are dynamic individuals that have their own unique personalities; some are calm and easy to work with and some of them are very high-strung," Schmidt said. Identifying the temperament in cattle is important because, as recent research from Schmidt indicates, temperament may have an impact on beef quality.

Changing how producers manage their cattle may have a big impact, Schmidt said. Temperamental cattle actually have altered quality grades; they may not grade as high after harvest as do the calmer animals. Separation of the calm cattle from the temperamental ones prior to, or upon arrival at the feedlot might allow producers to concentrate more on the management of calm cattle. Research has proven that temperamental cattle also have altered immune and stress responses compared to calmer animals, so there is a need to look at how temperamental cattle are managed, he said. Research conducted by Schmidt and his colleagues has demonstrated that many temperamental cattle do not exhibit outward signs of illness, so the sick, temperamental cattle may be overlooked.

Separating the calm cattle from the temperamental ones may possibly help to prevent the spread of disease, Schmidt said.

IMPROVING ANIMAL HEALTH

Another aspect of Schmidt's research is the role health plays in the final product.

"We have looked at different aspects of improving the animals' health," he said. "If we can maintain healthy animals, we are going to increase our quality grade, increase our production and increase our food safety."

For the last several years, Schmidt has studied many ways to improve animal health, including feeding antioxidants, reducing stress, changing nutrition strategies and feeding probiotics.

Currently, respiratory disease is the most devastating disease in the cattle industry, Schmidt said, so he also researches ways to reduce or eliminate the disease.

"Respiratory disease annually costs the beef industry about a billion dollars a year," Schmidt said.

A part of Schmidt's health research leads back to temperament, he said. In a recent trial conducted by Schmidt and his colleagues at USDA-ARS and at Kansas State University, temperamental cattle show a lower rate of respiratory disease than calm cattle at the time of harvest. By separating the calm cattle from the temperamental ones, producers may be able to focus more attention on the calm cattle that are more susceptible.

Schmidt looks at stress and its impact on cattle and respiratory disease. A stressed animal that is exposed to a pathogen or a disease is more likely to get sick than an animal that isn't stressed, he added.

When an animal becomes stressed, it weakens the animal's immune system and the immune response, he said. Schmidt studies the triggers and prevention of stress and the changes that can be made through management strategies so the immune systems of the cattle remain healthy.

Schmidt also has studied the impact of transportation stress that occurs during shipping of cattle. The results of this trial suggest that the physical handling of the cattle prior to transportation is more stressful than the actual act of transporting. These results suggest that alterations to how cattle are handled prior to and during loading may have a greater impact on the stress than the actual event of transportation.

"The more aggressive the person is, the more stress that is put on the animal," Schmidt said.

REDUCING E. COLI

Schmidt's research also includes ways of reducing pathogenic strains of *E. coli*. Escherichia coli is a naturally-occurring bacteria located in the gastrointestinal tract of all mammals, Schmidt said. While most strains of *E. coli* are not harmful, there are some strains of *E. coli* that can cause foodborne illness.

Processing facilities, Schmidt said, do a "phenomenal job" every day of reducing *E. coli* contamination. As soon as the animal is harvested, it is washed completely clean.

"We are even to the point where we are now pasteurizing carcasses," he said, by steaming the outside of each carcass to 180 degrees F. — almost to the point of sterilizing it — before it is fabricated, or cut into sections. In the past 10 years, Schmidt said, there has been a significant reduction in *E. coli* O157; however, he added, there always is room for improvement.

Schmidt's work looks at the entire beef production chain and how pathogenic *E. coli* contamination can be reduced in the feedlot and in the harvest facilities.

Schmidt and his research team have found that including citrus byproducts in cattle feed can reduce the occurrence of *E. coli* O157 in the gastrointestinal tract of cattle. Citrus byproducts are obtained from the production of orange juice or lemon juice, he said. However, there is not enough of the product to feed all of the beef and dairy cattle in the United States, so Schmidt is studying other options, such as feeding probiotics. Probiotics are non-pathogen bacteria that have a beneficial effect when fed to either a human or an animal.

The probiotic research is promising, he said; the probiotic bacteria colonize in the gastrointestinal tract so the *E. coli* O157 bacteria cannot.

ONE GOAL: high-quality, safe beef

by Sydney Hansen

VIDEO

When consumers look at beef in the display case, they are confident that beef is a high-quality and safe product to consume. Thanks to research conducted at the University of Nebraska–Lincoln, consumers can continue to be confident in that safe, wholesome product.

UNL MEAT SCIENCE IS HIGH-PAYOFF SCIENCE
challenging traditions, developing results

by Sydney Hansen

VIDEO

"Beef is great food, it's full of nutrition and it's full of vitamins, minerals, protein, and essential elements for healthy living," said Chris Calkins, professor of animal science at the University of Nebraska–Lincoln. Calkins' research looks at beef quality from what the animal is fed to the safe, tender, flavorful beef that ends up on consumers' plates.

"NEBRASKA is the epicenter of beef research and beef quality," he said. "We have the technology, the animals, the weather, the feedstuffs and we produce great-tasting beef."

And UNL has Calkins, who, with fellow researchers, has challenged traditional ways of cutting down the beef carcass, resulting in added billions of dollars to Nebraska's economy.

RESEARCH YIELDS HIGH-DOLLAR RESULTS

Historically, the beef carcass was cut with hand saws and knives because that was the best technology available, he said. These traditional methods yielded the cuts consumers have been accustomed to buying for the last hundred years.

Calkins' research involves deconstructing the carcass in new ways, enabling himself and his team to identify new, high-value cuts of meat that consumers love to eat. One of those famous cuts of meat is the steak commonly called the "Flat Iron," which comes from the shoulder of the animal, also known as the chuck.

"When we started this project in cooperation with colleagues at the University of Florida — and funded by the Beef Checkoff — there were no Flat Iron steaks recorded as being sold," he said. In the last few years, the average has been more than 90 million pounds of Flat Iron steaks sold just in restaurants, not including those sold in grocery stores.

"It has had a profound economic impact," Calkins said. The project added between $50 and $70 in value to every beef animal harvested in the United States, he said. The U.S. harvests about 25 million animals each year, which amounts to an annual impact of $1.5 billion each year in the United States.

"Nebraska produces over 20 percent of the beef in the United States, so over a five-year period, that is $1.5 billion in impact that has happened right here at home, in Nebraska," Calkins said.

During the process of identifying and testing different cuts of beef, Calkins looks at what traits influence consumer desires, such as tenderness, flavor, color, composition, consistency and marbling, which is "little flecks of fat in the lean," he said. Then, he begins to determine the optimal use for that particular muscle. Each cut of beef has an optimal use and cooking technique; for instance, using a cut of beef intended for slow roasting may not produce the desired result if it is cooked as a steak, grilled or broiled quickly.

Calkins' work not only has identified the Flat Iron steak; it has identified other previously undervalued cuts that, like the Flat Iron, used to be cut into roasts or ground into hamburger.

"By identifying what the opportunities were with the optimal use of each cut, it becomes a 'win-win' for everyone," Calkins said, noting that these cuts are just as flavorful, tender and satisfying as the more traditionally popular cuts.

"The advantages of identifying cuts like the Flat Iron steak is that it is a very specific cut of meat and when consumers buy it they know what they are going to get," Calkins said.

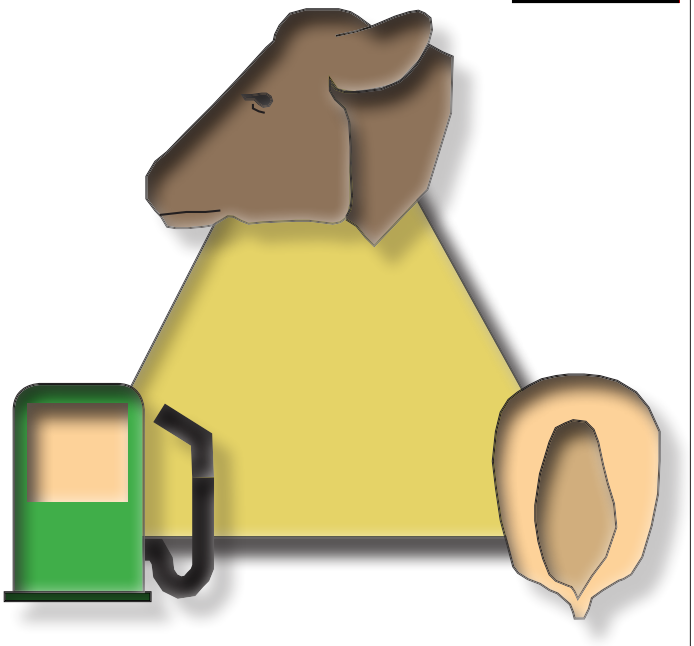
The impact of identifying new cuts from the beef carcass not only has added value domestically, but the new cuts have been adopted the world over, he said.

"I have been to England twice; they continue to ask for help understanding what our process was and what the opportunities are to add value," he said. "We have the opportunity not only to add value, but do something good for consumers by the way we cut beef."

THE GOLDEN TRIANGLE OF BEEF EXCELLENCE

"Here in Nebraska we have what we call 'the golden triangle'; we have corn, we have ethanol plants, and we have cattle, all very close to each other," Calkins said. Because of that, Nebraska has perfected a system that produces the highest quality, most nutritious and safest beef in the world, he added.

Nebraska's weather provides the opportunity to produce feedstuffs that allow animals to thrive, he added. One of those feedstuffs is distillers grains, which also has been



extensively studied by Calkins and other University of Nebraska–Lincoln beef specialists. When corn is used to make ethanol, distillers grains are the cereal coproduct of the distillation process. Calkins' research on the effect of wet distillers grains on meat quality indicates that the addition of vitamin E to the animals' diet allows the meat products to retain their characteristic bright color, consistent texture, flavor and overall eating experience that consumers expect.

NEBRASKA'S OPPORTUNITIES

"We waste a lot food the world over because we don't think the quality is very good, so for me, quality is number one," he said, "but we need to understand that we anticipate nine billion people on Earth in 2050." Nebraska will be under pressure to increase the volume, or the amount of food, all the while assuring it is safe, he added.

"I want to be sure that my program remains relevant, addressing issues of importance to citizens of Nebraska, and that the University of Nebraska–Lincoln is able to maintain the kinds of research that are going to help the state, the economy and consumers," he said.

Many of Nebraska's opportunities lie in the young people who want to pursue educations as animal scientists or meat scientists, he said. The University of Nebraska–Lincoln Department of Animal Science welcomes new students in its undergraduate and graduate programs.

"We are the epicenter of beef research and beef quality and as a result, it gives us a wonderful opportunity to train students and to make them aware of the global impact of their activities," Calkins said.

EDUCATING the next generation

I think it should leave the average consumer out there a degree of comfort in knowing that the next generation of beef cattle professionals coming along is going to be well-prepared to handle whatever issues arise.

Matt Spangler
University of Nebraska–Lincoln
Associate Professor of Animal Science

We have a tremendous demand for young people to go into management, not just here in Nebraska, but in the U.S. and in other parts of the world.

Galen Erickson
University of Nebraska–Lincoln
Professor of Animal Science

NEBRASKA BEEF INDUSTRY SCHOLARS PROGRAM trains students to lead

by Stephanie Smolek

VIDEO

The Nebraska Beef Industry Scholars program is part of the University of Nebraska–Lincoln's plan to prepare the next generation of leaders in the beef cattle industry. Training future beef cattle industry leaders is important to consumers and to current industry professionals, said Matt Spangler, UNL associate professor of animal science.

"I THINK IT SHOULD leave the average consumer out there a degree of comfort in knowing that the next generation of beef cattle professionals coming along is going to be well-prepared to handle whatever issues arise," he said.

Spangler is the coordinator of the Nebraska Beef Industry Scholars program, a four-year certificate program for UNL College of Agricultural Sciences and Natural Resources students during which they learn to think and communicate objectively and logically, using beef as an example.

"The next generation of beef cattle producers — beef cattle leaders — will hopefully be able to think of solutions to problems that we have now, but more importantly, problems that we can't even fathom that we're going to have, but that will occur," Spangler said.

Equally important, Spangler said, is the program's global influence.

Nebraska has an important place in global beef production, according to Spangler. This means Nebraska's beef leaders will take on leadership roles nationally and internationally, he said.

"Employers look at Nebraska for knowledgeable young scholars that have leadership potential, and we have to do all that we can to make sure that we're able to deliver on that," Spangler said.

PROGRAM GROWTH

Class sizes are gradually increasing, according to Spangler. Roughly 60 students are currently enrolled in the program, and freshman class sizes have ranged from 12 to 20 people, he said.

"I want us to be known not just for having this program, but for the students that complete it really being sought after in the job market," he said.

As national recognition increases, students from other states will realize that if they want to be competitive for a job in the beef cattle industry, "there's only one school to go to, and that's UNL," Spangler said.

One of the goals of the Nebraska Beef Industry Scholars program is to help students understand the scope of the beef industry.

"So many students in the program, either directly or maybe a couple of generations removed, have been involved with beef cattle from a production sense," Spangler said. "There's a lot more to the beef industry."

Spangler said each program participant learns about the beef industry from the program's required internship in the

beef industry. However, this large industry encompasses many disciplines, including production agriculture, financial management and environmental quality, he added.

By completing internships, job-shadowing and attending beef industry events, students are able to become acquainted with many industry experts, as well, Spangler said.

Spencer Eisenmenger was one of the first participants in the Nebraska Beef Industry Scholars program

CREATING BEEF INDUSTRY LEADERS

The Nebraska Beef Industry Scholars program started in 2007. It is one of UNL's many implementations of the Nebraska BEEF initiative, which states that UNL will take a leadership role in beef cattle education. The BEEF acronym stands for Beef Education Excellence for the Future and includes student education in the areas of science, technology, business and leadership. For more information about the UNL BEEF initiative, visit *beef.unl.edu*.

University leaders decided UNL would be a center for beef research and undergraduate and graduate student beef education because of Nebraska's beef legacy, UNL's legacy and the importance of beef cattle production to the state's economy, Spangler said.

In response, the beef industry in Nebraska stepped up to fund the Nebraska Beef Industry Scholars program. Private and organizational donors keep students from having to incur a substantial cost to participate in the program, he said.

Although the program is still relatively new, Spangler said, he expects to see students in leadership positions at state, national and international levels, implementing what they learned in the program.

Recent program graduates have attended state beef cattle conventions, participating and speaking on various subjects, Spangler said. They are in committee meetings, actively discussing policy, he added.

MULTIDISCIPLINARY LEARNING

Several faculty members within the College of Agricultural Sciences and Natural Resources assist Spangler in teaching Nebraska Beef Industry Scholars classes and in annual evaluations of the program, Spangler said.

In order to complete the program, students take a specialized suite of classes in various areas of agriculture, animal science and communication.

"It's really a multidisciplinary, multi-departmental program, in the sense that we have more than just animal science students and more than just animal science instructors," Spangler said.

Students apply to the program during the fall of their freshman year. Then, during the spring semester of the freshman year, students take a beef seminar course. In this course, they learn about the history of the beef industry and the breadth of the industry from people who are involved in it day-to-day, Spangler said.

BEEF bites

The beef industry is critical to the economy of the U.S. and to the economy of Nebraska.

The following fall semester, students take a course that focuses on the central issues in the beef industry. In this class, students research a topic, take sides and debate the issue. According to Spangler, this is a learning experience for most students.

"You can imagine, given a student's background, they may inherently find themselves on one side of an issue," he said. "Through this class, they may be assigned to debate the other side, and I think that's an invaluable experience."

In the spring semester of the sophomore year, the students plan a summer study tour with Spangler, as well as plan internships. The group visits beef-related enterprises in parts of Nebraska, Colorado and Kansas, Spangler said.

In the junior year, Nebraska Beef Industry Scholars take a course on crisis communication and issues management, learning to communicate about beef issues to a variety of audiences. They also take a course focusing on issues related to meat safety, Spangler said.

The senior year of the program brings together everything the students have previously learned, Spangler said. In the fall, they work in conjunction with the National Cattlemen's Beef Association to host a beef summit.

Each spring, the senior class attends the annual National Cattlemen's Beef Association convention where they sit in on policy discussions at a national level. Before graduation, each student must write a policy and orally defend it, Spangler said.

A group of Nebraska Beef Industry Scholars visiting the Nebraska Sandhills, where many Nebraska cattle graze and grow

Contents

STUDENT DIVERSITY DRIVES THE PROGRAM

A diverse group of freshmen enters this program every year, he added. Some students come from ranching families; other students do not have an agricultural background at all, according to Spangler.

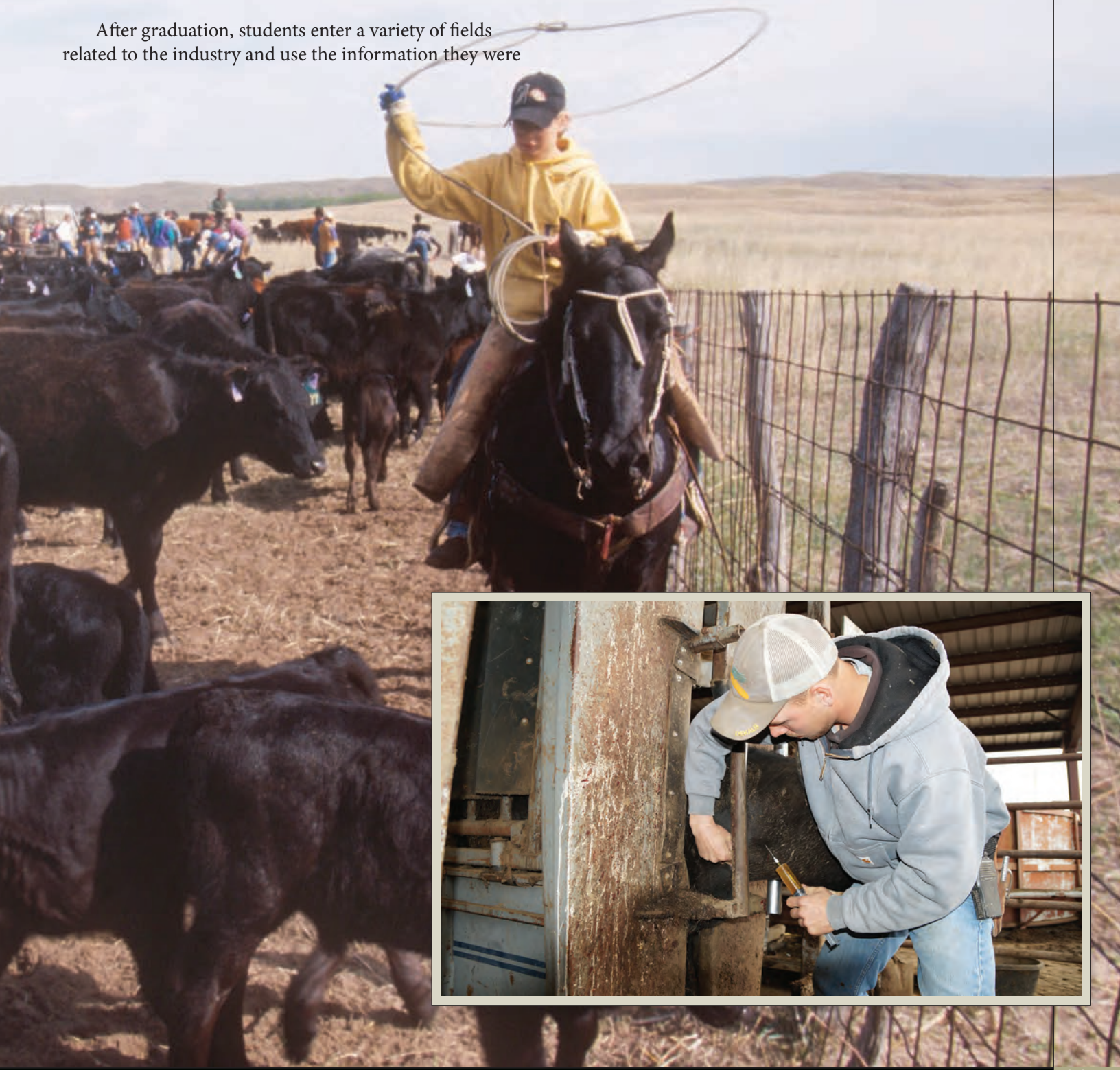
The students also vary in majors and expertise, he said.

Overall, these differences have been beneficial, Spangler said. "Students are actually able to learn from each other," he added.

After graduation, students enter a variety of fields related to the industry and use the information they were provided in the program. Spangler said he tries to tailor the program to each individual's needs.

"That's what the program is supposed to do, is help people find their niche and make them better when they get there," he said.

The program also is adjusted for students who graduate from UNL a semester early, study abroad during a semester or take a semester of classes off for an internship, Spangler said.



EISENMENGER, a native of Humphrey, Neb., spent his first year of college at Southeast Community College in Lincoln. Before his sophomore year of college he transferred to UNL to study animal science with an emphasis in animal production and management. He was part of the first group of Nebraska Beef Industry Scholars, but because he missed the first year of the program, he did not receive his certification in NBIS.

As part of the program, students enroll in special courses developed specially for NBIS students. There are classes devoted to the cattle industry policy, issues, communications, and industry experience. One part of the program that Eisenmenger particularly enjoyed was the cattle industry tour.

"It was awesome. We did a tour out in western Nebraska and eastern Colorado. We looked at a bunch of feedyards. We went and toured packing plants. A lot of different neat places, and I don't think I'll ever be able to go on a tour like that again," Eisenmenger said.

Several UNL faculty members helped Eisenmenger both with academics and with his NBIS involvement. One of those people was Matt Spangler, UNL associate professor of animal science and beef genetics extension specialist.

"Matt Spangler was a lot of help. He is a very easy guy to talk to. He will bend over backwards for you," Eisenmenger said.

Galen Erickson, Nebraska Cattle Industry Professor of Animal Science and UNL beef feedlot extension specialist, also was helpful to Spencer in preparing for his career in the beef industry.

> ***"We have a tremendous*** *demand for young people to go into management, not just here in Nebraska, but in the U.S. and in other parts of the world."*
>
> *— Galen Erickson*

"Galen knows his stuff. You could tell he was well versed in feedlots and everything that goes with it. I went to him a lot of times for advice as far as what to do and in the program. He helped me out quite a bit as far as his contacts in the industry," Eisenmenger said.

Upon graduating from UNL in 2009, Eisenmenger returned to his family's operation near Humphrey. Eisenmenger Farms is a custom commercial feedyard owned by Spencer's father, Joe, uncle John, and grandfather Jim. According to Spencer Eisenmenger, the operation feeds 10,000 cattle at any one time. Eisenmenger Farms also raises 1,200 acres of corn and soybeans annually. The corn they raise is fed to the cattle. In addition to corn they also feed hay, cornstalks, corn silage and distillers grains to the cattle as part of their nutrition program.

Eisenmenger said he enjoys many aspects of the daily operations at the feedyard. "I can say 100 percent that it's different every day. I like not doing necessarily one thing every day, day after day. I enjoy being outdoors. I get to work with a lot of good people, and I love working with cattle, too."

As a young person in the industry, Eisenmenger said that it is a great time for young people to get involved in the beef industry. While in the Nebraska Beef Industry Scholars Program, he met beef industry leaders who wanted to help young people get started in beef cattle production.

"People that have 'been around the block' in the industry are willing to help. They are willing to open their doors and give you advice if you ever need it. They are excited for young people to come back in the industry," Eisenmenger said.

Eisenmenger says he believes that college students studying agriculture should take advantage of the opportunities available to them to get a start in the industry.

"Meet as many people as you can and get involved in classes. Get involved with your professors," Eisenmenger said. "The more you get involved the better off you'll be, and I strongly recommend the Beef Industry Scholars Program."

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NEBRASKA BEEF INDUSTRY SCHOLARS

spotlight: Spencer Eisenmenger

by Levi McPhillips

The University of Nebraska–Lincoln is finding new ways of getting young people involved in agriculture. The Nebraska Beef Industry Scholars Program (NBIS) was developed by faculty at UNL in 2006 to encourage young people from various backgrounds to become involved in the beef industry. Spencer Eisenmenger was one of the first students to be a part of the program.

FEEDYARD MANAGEMENT INTERNSHIP PROGRAM
hands-on training for lucrative careers

by Stephanie Smolek

VIDEO

Nebraska has about 2.5 million beef cattle in feedyards on any given day, and the state is feeding 4.5 to 5 million beef cattle in a year. Additionally, there are about 750 feedyards in Nebraska with more than 1,000 head of cattle, said Galen Erickson, professor of animal science and feedyard extension specialist at the University of Nebraska–Lincoln.

THE UNL FEEDYARD Management Internship program was created to provide students with the expertise necessary to manage feedyard facilities — a career that not only is necessary, but financially lucrative.

For every 1,000 animals in a beef cattle feedyard/feedlot, there is one employee tending to them. Once the number of cattle exceeds 1,000, the facilities require additional management expertise, Erickson said.

In Nebraska, the average age of these managers is rising. At the same time, the global demand for grain-fed U.S. production type beef is also going up, he added.

Together, these circumstances have created a tremendous demand for young people interested in a feedyard management career at one of Nebraska's 750 larger feedyards, he added.

"I would argue that every one of those operations require some type of management expertise," Erickson said. "So, out of those 750 feedlots, we think that there's at least an opportunity for one young person in every one of those."

Almost every week, and at least every couple weeks, Erickson said he receives a call from a feedyard, looking to fill an employment position with a qualified young person who has gone through the Feedyard Management Internship program and is interested in feedyard management — a career that is averaging $72,000 in annual compensation.

"We need young people that want to step in that role and take on all that responsibility," Erickson said. "There's a lot of responsibility to make sure cattle are properly cared for, properly handled, properly fed, and then that the economics are favorable. That requires a lot of skills and frankly, we believe, an education here at the University of Nebraska–Lincoln."

Erickson is one of three faculty members at UNL leading the Feedyard Management Internship program. In this program, recent college graduates from any undergraduate degree gain the knowledge and experience to prepare them for management positions in the feedyard industry, he said.

"There isn't another program structured quite like this one anywhere else in the world that we're aware of," Erickson said. The goal is to teach students about the different facets of feedyard management and operation in order to prepare them for a long-term career in feedyard management, he added.

PARTICIPANTS

In the early years, this program was male-dominated, Erickson said. Increasingly, more female students are participating and now comprise the majority of participants, he added.

This is encouraging, Erickson said, but raises a concern that not as many male students are pursuing an education before entering the workforce.

"With the types of operations we're going to have and the amount of skills required by those in management, we think that there's a demand for both and that we should actually be 50-50 males and females," Erickson said. "In some respects, we want to keep this balance, not because we don't want more female students, but because we want to make sure we've not lost track of where all the young men are going."

About half of the students in the program come from states other than Nebraska, Erickson said. Their feedyard experience has to be in Nebraska because in the state, students will have a great experience and will be exposed to Nebraska's industry, he added.

On the other hand, he said, some students who grew up on feedyards in Nebraska choose to go to other major cattle feeding areas of the U.S. for their on-site internship experience.

"We've had interns work in feedlots that are 1,500-head family operations to 100,000-head family operations and really anything in between," Erickson said. "We've had feedyards participate from Texas to the Pacific Northwest and a lot throughout the whole state of Nebraska."

According to Erickson, there also has been an increasing interest in the program from the international community and international students. Erickson said he hopes that in the future students who receive their college education outside of the United States will be able to participate in the internship program. The program has not yet adapted to accommodate these students.

When the program does accommodate international students, the students will be able to take the skills and knowledge they learn in the internship program and apply them in their home country, Erickson said. Some international students may even choose to stay and work in the United States' feeding industry, he added.

"We have a tremendous demand for young people to go into management, not just here in Nebraska, but in the U.S. and in other parts of the world," Erickson said.

PROGRAM REQUIREMENTS

A desire to pursue this career is important for program participants, Erickson said, and is one of the requirements to be accepted into the program. The other two criteria are the ability to work hard and the ability to work well with people, he added.

"Those are not very difficult qualifications, but they're important," Erickson said.

About 100 feedyards in Nebraska and in other states have participated in the Feedyard Management Internship program since it was started by UNL faculty member Terry Klopfenstein in 1988, Erickson said. The owners of these feedyards expect UNL to provide hard-

working interns with a passion for the industry, he added. To date, over 120 students have completed the program.

"If you don't really want to do it, there'll be some cold, windy, snowy days and there'll be some hot, humid days, and those days are a lot harder if you're not really interested in the program," Erickson said.

Klopfenstein, Erickson and Jim MacDonald — associate professor of animal science at UNL — review student applications before interviewing them in the spring each year.

Throughout this application process they learn why a student wants to participate in the program and what they hope to learn from it, Erickson said.

The program serves as a way for young people to determine where they want to work after they graduate, he added.

Some students decide after doing the internship that, instead of working in feedyard management, they would rather pursue a career in the cow-calf industry or in a service industry related to feedyards. Others go onto graduate school at UNL, and still others have changed career paths in order to stay in feedyard management, Erickson said.

DURING THE INTERNSHIP

The Feedyard Management Internship program lasts seven months and is funded 100 percent by organizations in the Nebraska feedyard industry, including the Nebraska Cattlemen Research & Education Foundation Fund and the Nebraska Bankers Association.

To begin, the group of usually five or six students participates in a six-week class session at UNL. For three hours a day the students and faculty discuss what information is vital to know before starting work at a feedyard, he said. These topics include feedyard beef cattle nutrition, animal health, feedyard business management and personnel management.

Then in mid-July, each student starts work on a specific feedyard. Until the end of November or early December, each intern participates in the day-to-day operation and management of the feedyard, Erickson said.

Their time at the feedyards usually is divided into the major segments discussed in their class session: nutrition, animal health, maintenance and management.

AFTER THE ON-SITE FEEDYARD EXPERIENCE

After the feedyard internship, students in the program return to UNL to discuss their experiences with each other and with faculty members.

There is not one clear way to manage a feedyard, and inevitably, the students in the program will have learned different ways to do the same things, Erickson said. Bringing them back to campus gives them an opportunity to learn these different methods from each other, he added.

Erickson said the most important aspect of this program is personnel management, but students do not understand its importance until after their on-site experience.

"You can just see the transformation in those students," he said. "To be honest, managing cattle is easy. Working with people is sometimes more of a challenge."

Many students then begin careers with the feedyards where they did their internships, Erickson said, while other interns may begin work with different feedyards.

PRIORITY ONE: educating students

VIDEO

by Mary Garbacz

Based on an interview by Monica Casey

Educating the next generation of animal scientists and industry professionals is the top priority of the University of Nebraska–Lincoln Department of Animal Science, focusing on helping students become the passionate, motivated, experienced leaders the animal industry will continue to need.

DENNIS BRINK is the department coordinator of undergraduate teaching and advising. His career has focused on advising, but also teaching and research in the area of beef animal nutrition.

Nebraska has all of the resources related to beef cattle, including UNL research facilities and expertise, as well as the state's natural resources, such as land, water and climate, so beef education is a natural fit at UNL.

"The Nebraska beef industry — this is the center. This is it," he said.

FOCUS ON STUDENTS

Nebraska's positioning as the epicenter of global beef production has led the department to further emphasize student success.

"In the last five years, we've really been thinking about beef excellence within the department," Brink said. "Put-

ting us at the center of beef education would not only contribute all we can do in Nebraska, but also the academic success of students, starting when they are freshmen," he added.

Brink said he is privileged to be able to interact with students who want to learn — and the favorite times in his career have been when students have experienced successes, or "I got it" moments. Those moments don't just happen — they are the result of faculty members who create opportunities for students to become active with the material, to become engaged in learning and to incorporate technology into classroom learning.

Brink and his colleagues also find opportunities for students to network with industry professionals.

"I believe the network for beef education for students is here," Brink said. The executive vice president of the Nebraska Cattlemen, Michael Kelsey, told a group of high school students that if you're a leader in the Nebraska beef industry, you're a leader in the national industry because the leaders in the beef industry come from Nebraska, Brink related.

So, the department developed a program to connect students with leaders in the Nebraska beef industry.

PEOPLE, PASSION, PURPOSE

"The Nebraska Beef Industry Scholars (NBIS) program is modeled around working with leaders in the beef industry," Brink said. Matt Spangler, associate professor of animal science, coordinates the program, which is supported by the efforts of faculty from the Departments of Animal Science, Agricultural Economics and Agricultural Leadership, Education and Communication.

The NBIS program is a four-year certification program for UNL students, designed to develop well-rounded industry leaders for the future. The program provides participants networking opportunities with Nebraska beef industry leaders and a specific schedule of interdisciplinary classes beginning in the student's freshman year. The NBIS program is part of the UNL Beef Education Excellence for the Future (BEEF) initiative to enhance beef education in Nebraska. Brink said students may apply for the program at: *animalscience.unl.edu/anscnbis/*.

"An ideal applicant has passion for the beef industry, wants to be a leader, is open to new ideas and to networking with people," Brink said.

SOLID FOUNDATION

Science is constantly changing, with new discoveries and new technology, but the solid foundation in the sciences doesn't change, Brink said.

"The science, the biology, and then interpersonal skills — being able to have confidence and interact with people — the desire to learn ... those are still the same," he said.

Changes in scientific discovery in past years can be described as "macro to micro," Brink said.

"I started teaching feeds and feeding, and what I see as the change is that we started with thinking about the whole animal," he explained, including how the whole animal interacted with the environment and with the feed it was given. Now, he said the focus is on the cellular level.

"We've learned so much about proteins and genetics," he said, citing an example from a class in which he taught about diuretics and a possible relation to autism, including neural transmitters and chlorine.

Brink said it is a team approach in helping students build that solid foundation in the sciences.

"I'll take 51 percent of the responsibility for getting the information and helping you learn it, but the student has to take the other 49 percent and get engaged with it," he said.

Another part of that team approach is academic advising. Students learn about networking, scholarships, interdisciplinary learning opportunities and more when they regularly visit a department adviser. They also receive assistance in registering for classes that will allow them to complete their college careers in a timely fashion.

"My philosophy of advising is that we need to be knowledgeable and available; not only knowledgeable about course requirements, but also opportunities for internships, for experiential learning — all of the things that go with a complete education," Brink said. He also wants to become well-acquainted with each student so he can connect their interests with opportunities.

"If I am knowledgeable of the student and the things they need to do to succeed, I can see results. And it's a highlight for me to see a student succeed," he said.

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