VOL. 2 ISSUE 4 · MAY 2022

CATTLECAL NEWSLETTER

ANNOUNCEMENTS

Welcome to the CattleCal newsletter for May 2022! In this issue we have exciting information on the amount of fat that should be in a feedlot diet, the career and research of Daniel Schaefer, an animal science nutrition professor at University of Wisconsin-Madison, and a look at a study examining the effect of free fatty acids in supplemental fat on the performance of feedlot cattle. If you would like to hear more detailed conversations about the articles in this issue, look for our CattleCal podcast on Spotify. Descriptions of this month's episodes and a link to the podcast can be found on page 3. If you have any questions, comments, or would like to submit a question for our Quiz Zinn segment, feel free to contact us. Our contact information can be found on the last page of the newsletter.

This issue:

DR. ZINN RECEIVES PLAINS NUTRITION COUNCIL LEGEND IN FEEDLOT NUTRITION AWARD

This past April Dr. Richard Zinn, professor of animal science at UC Davis and frequent guest on the CattleCal podcast, recieved the Plains Nutrition Council Legend in Feedlot Nutrition Award. Dr. Zinn's work with beef cattle energetics, metabolizable amino acid requirements, grain processing, starch utilization, and the use of technologies to improve growth performance, health, and profitability of feedlots has made his work stand apart as such an important contribution to science and the beef industry. He continues to make a significant impact with current research and was honored for his contributions. We would like to extend our sincerest congratulations to Dr. Zinn.

If you would like to learn about Dr. Zinn's long and productive career, our CattleCal podcast episode #22 (https://open.spotify.com/episode/7tK1UfPyKpyUqHtxZNbHKF?si=u6V5-77hQsS8xFxJ1U-6VA) covers his start as a young worker for the research station through graduate school at Brigham Young University and the University of Kentucky to his career as a professor at UC Davis. It is an incredible story filled with the knowledge gained through his 40+ years working in feedlot research.

If you would like to hear more of the extensive knowledge of Dr. Zinn related to feedlot management and nutrition, we have many Quiz Zinn episodes on the CattleCal podcast. In those episodes he covers everything from urea to corn processing to almond hulls and much more. CattleCal episodes can be found on Spotify or Apple Podcast.

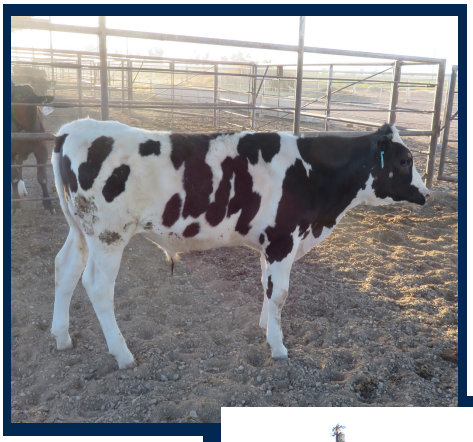
THIS MONTH IN RESEARCH

In April we continued our two projects. Cattle are performing slightly better than expected. For April, average temperature was 71.3° F (6° F greater than March), average maximum temperature was 88.2° F (6° F greater than March), and average minimum temperature was 53.9° F (6° F greater than March).

DAYS 56-84 PERFORMANCE SUMMARY

	Holstein	Crossbred
Body weight (d 56)	460 lbs	467 lbs
Body weight (d 84)	559 lbs	572 lbs
ADG	3.55 lbs/d	3.79 lbs/d
DMI	14.8 lbs/d	14.6 lbs/d
F:G	4.17	3.85

March 2022



April 2022

CATTLECAL PODCAST MAY EPISODES

Quiz Zinn - CCP#053

In this episode, we asked Dr. Richard Zinn about how much fat there should be in a feedlot diet.

Career Call - CCP#054

This week Brooke Latack and Pedro Carvalho called Dr. Dan Schaefer, emeritus professor in the department of animal science at the University of Wisconsin-Madison, to discuss his beginnings on the farm to work with carcass characteristics of swine to his career in rumen microbiology and ruminant nutrition.

Research Call - CCP#055

This week Brooke Latack and Pedro Carvalho speak to Dr. Dan Schaefer again to discuss his vast work in the effect of vitamin E on meat color longevity. We discuss how it came about, the science behind the discovery, and what is needed to implement it in today's beef system.

Feedlot Research Call - CCP#056

This week, Pedro Carvalho and Brooke Latack discuss research looking at the effect of free fatty acids in supplemental fat on feedlot cattle performance.

Listen on Spotify at this link:
https://open.spotify.com/show/6PR02gPnmTSHEgsv09ghjY?si=2zV59nGbSE2mf8DiOqZLhw

Have any questions, comments, or suggestions? Want to send in a Quiz Zinn question? Contact the creators through the below email or through their social media profiles.

- Email: cattlecalucd@gmail.com
- Website: cattlecal.sf.ucdavis.edu
- Instagram: @cattlecal

QUIZ ZINN

How much fat should be in a feedlot diet?

The total level of fat in the diet should not exceed 7%. A lot of feedlots in the past have struggled with that. With including DDG or other things that have fat in them, they've exceeded that amount of fat, so they have less efficient utilization of the energy. I strongly recommend that it not exceed 7% total fat in the diet. That would mean somewhere in the neighborhood of 2-3% supplemental fat.

When feeding too much fat, is it an issue with microbes in the rumen being affected or absorption post-ruminally is what is being affected?

In terms of level of fat, the problem is largely the limitation of the small intestine to digest the fat. The fat entering the small intestine of cattle and ruminants is going to be highly saturated and that makes it very difficult to digest. Fortunately, these animals are designed to digest highly saturated fat, unlike monogastrics. They produce a tremendous amount of bile, but they don't increase bile production with level of fat intake. As we get too high in the level of total fat entering the small intestine it exceeds the capacity of the bile to emulsify the fat and make an adequate micelle for absorption. As you go above 7% fat in the diet, the digestibility of fat starts dropping quickly.

What are the other benefits of supplementing fat in the diet?

When we add fat to the diet, we actually increase energy intake a little bit more than we would have if we didn't add it to the diet. I don't know the reason for that. If you look at it in terms of the number of studies that have been conducted, in about 75% of the studies where fat was added compared to no additional fat, it increases average daily gain. This is an important consideration. I think most nutritionists realize that, but as fat prices go up and we want to pull it out of the diet, we need to remember that another benefit from fat that's extra-calororic (i.e. has not anything to do with directly with the net energy value of fat itself) is that the addition of fat to the diet will likely increase the cattle's average daily gain. Just from that alone it will increase gain efficiency.

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Are there any considerations they should take when they're starting to supplement extra fat?

That's an important question. Cattle need to adapt to the fat in the diet. We should start slowly. Most feed lot diets would not have more than 2% supplemental fat in the in the receiving diet. Then you can go ahead and move it out to 2.5-4% after a period of adaptation. In the receiving diet, the levels should be less than 2% and that will prevent any negative effects in terms of animals coming on feed.

CAREER CALL WITH DANIEL SCHAEFER

This week we talk to Dr. Dan Shaeffer, emeritus professor in the department of animal science at the University of Wisconsin-Madison.

Where are you from and what do you do?
I am from the state of Wisconsin. I grew up on a diversified livestock farm in eastern Wisconsin. I'm living in Madison, WI. I'm now a retired professor from the Department of Animal Sciences (now it has become the Department of Animal and Dairy Science). I was a faculty member at the University of Wisconsin from 1981 until 2019. At the end of the last decade, I retired. Since the pandemic, I have been retired. I take a granddaughter to school three mornings a week. My wife and I are going through a remodel project, so my wife and I are living with our daughter and granddaughter in their house. They're graciously having us while our house is undergoing a project.

When did you decide you wanted to work with livestock and do the job you're doing?
It occurred overtime. I had a lot of different animal species experiences. Dogs and cats. I had an interest in pigeons when I was in 3rd grade. I had experience with chickens, pigs, beef cattle, and horses. I think it was when I was about 10 years old, I said to my parents that if I was going to study any species, it was going to be beef cattle. I went to high school and I happened to have a classmate in high school who was also as dedicated to beef cattle as I was becoming. He was interested in polled Herefords and he helped to develop my experience. Then later, after I had determined that I was going to do a career in animal agriculture, or at least I was going to learn more about animal agriculture, he recruited me to come to the University of Wisconsin-Madison to a department in a major that was called meat and animal science. Once I came into the major of meat and animal science, then I had really found my academic home. I became totally invested in the major. After my bachelor's degree for a Masters degree, which happened to be done on a pork carcass composition question. After that I pursued my PhD with the dual interests of rumen microbiology and ruminant nutrition. My animal background as a youth played an important role. And, of course, my father was a farmer and my mother was a teacher, so I think that my path as a university professor in animal science was a combination of their two interests.

We usually talk about the role of mentors in a career path. It seems like you had a mentor in a peer you went to high school with that was a friend.
Yes, he has been my lifelong friend. He is still a Hereford breeder. He is an elite Hereford breeder. I actually began my faculty career at Purdue University. I was encouraged to apply for this position at the University of Wisconsin. This man who was my high school classmate called me to recruit me to come back to the University of Wisconsin and the state. He attended my retirement party in 2020. He's been with me my whole career.

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CAREER CALL WITH DANIEL SCHAEFER

Did you initially plan to go to grad school or did you discover that passion later?
When I discovered meat and animal science, I thought the practical use of a college education was to do something in business. I started out in what was called a business and industry option within the animal science major. I'm so pleased that I took those business courses like accounting and marketing. As I got down to graduation, I talked to one of my faculty mentors, a man named Bob Kaufman. I said I think I'm more interested in science. And he said, "I could have told you that long time ago. You need to be in science." He helped me then reorient my path toward graduate school, as I did my master's degree with him. I can't say that I knew as a high school student that I enjoyed science. In fact, I'm not sure I really did enjoy it that much. I had an inkling that I liked chemistry, but when I finally came into biochemistry, then it all came to life. Biochemistry was so much more fun than the things that came before it.

Did your background in farming and courses in accounting help you professionally?
Yes, for sure. I would never give up the accounting course that I had. Marketing is also so very important. In fact, one of the things that my department has historically been weak in is marketing. Universities typically market their campus but the departments usually don't take much of a role in marketing their department other than having some people out and doing extension work. Marketing is not a strong suit of animal science departments.

In your master's program you worked with swine, specifically with meat, and then transitioned to ruminant nutrition and ruminal microbiology for your PhD. How was that transition between species?
It was very good. The transition was even wider than that. I worked with pork carcasses. We developed the first regression equation for predicting fat free muscle in pork carcasses. The marketing of hogs has changed over the last several decades away from a number scoring system to a percent muscle system. I was very pleased to see that work and the subsequent graduate students who refined that work had an impact. When I was a senior, we had a research seminar course and in preparing my seminar for that course, I came across this book called The Rumen and It's Microbes, written by Bob Hungate. I had a mentor here in Wisconsin who was a graduate of the University of California, Davis. His name is Norlan J. Benvenga. Benvenga encouraged me to seek out a good solid program based on my interest in rumen microbiology and ruminant nutrition. He gave me three schools to interview at. The first school I contacted was University of Illinois. I was talking to two faculty members in the dairy science department at that time. Dairy science was separate from animal science at Illinois. I went to interview with Marvin Bryant and Carl Davis. Marvin Bryant was a very, very well-known rumen microbiologist, and Carl Davis was a less well known, but even better ruminant nutritionist. Davis was interested in the low milk fat syndrome. Dale Bauman and Jimmy Clark were there at the time. I got immersed in the dairy cow, even though I never really did any animal research in my PhD because all of my research for my PhD program was done in Bryant's laboratory culturing pure cultures of rumen bacteria and determining their requirement for ammonia. At the time there was a question about what the optimal rumen ammonia concentration is. My expertise in my PhD program was bacterial growth kinetics. I determined the half saturation constants for ammonia by six or seven predominant species of rumen bacteria. I went from pork to microbiology.

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CAREER CALL WITH DANIEL SCHAEFER

There were three schools that were suggested to me: Illinois, Michigan State where Werner Bergen was located, and UC Davis where Lee Baldwin was. I went to Illinois. It was close to Wisconsin, and it was a perfect fit. I have to say it was the best place in the world for me to do my PhD with those two interests. I just loved it.

What were the biggest challenges when you were finishing school and looking for jobs and starting at a young career as a faculty?

I had a very different experience in that regard, too. While I was in my PhD program, the animal science department at Purdue advertised the position in which they were seeking an assistant professor in basic ruminant nutrition and rumen microbiology. That sounded great to me, so I applied and interviewed for that position. I had not yet completed my PhD, but I was only six months away from completing my PhD. Purdue offered me the position. That was great. I accepted the position. I went back to do my research and I realized that I was not as close to finishing as my major professors and I had projected. There were delays along the way in my arrival with Purdue. They waited 21 months for me to show up on the faculty and it became quite embarrassing to me. Eventually my research blossomed, and I solidly answered the question that I was pursuing. I went to Purdue and started on the faculty. I had no postdoc experience. I was 27 years old when I started on the faculty at Purdue. I didn't do a lot of interviewing. I interviewed once.

What is something you had to learn quickly after becoming a faculty member that you didn't learn in graduate school?

Grantsmanship. When I came into the faculty position, times were changing. Instead of having ready financial support for graduate students, there was going to be the need to recruit financial support. I did not have experience in grant preparation as a graduate student. I needed to learn how to do that. I can say that I've developed some skill in that regard, but I was never as proficient as I needed to be. Having financial resources to support the exploration of my ideas was a challenge for me throughout my career. If I were to do one thing different or make a recommendation to others, it would be to enjoy the maturation that occurs while one is a postdoc. Especially these days, where the body of knowledge has expanded exponentially and the competition has become even more keen, development of one's ability to generate new knowledge is very important.

You eventually went back to Wisconsin to work as faculty there. Can you tell us about your job?

I left this beautiful job description at Purdue and came back to Wisconsin to really wear two hats. On one hand, I was the rumen microbiologist because there was no other rumen microbiologist at Wisconsin. The other hat I wore was to be the beef cattle nutrition research and teaching person. I developed a class in Rumen microbiology and I co-taught a beef cattle production course for my entire career. My appointment was teaching and research. With regards to research, when I came to Wisconsin someone called me and said that he had 22 Holstein calves that he had raised to weaning in his garage. He thought that there would be a very nice opportunity for someone to study the Holstein steer as a source of beef production. If you came from a native cattle background, as I did (which was primarily Hereford and Simmental) and all of my colleagues and those that were older than me, there were very, very few people who would stoop to study the Holstein steer. But here I was in America's dairyland.

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CAREER CALL WITH DANIEL SCHAEFER

On top of that, there was a packing plant here in Wisconsin that was advertising for another 100,000 head of finished Holstein steers on an annual basis. Eventually I connected up with that packing plant whose name is Packerland in Green Bay, and I did Holstein steer research with the beef cattle nutrition facilities that were at my disposal. I continued to do that research for most of the decades I was at Wisconsin. Never with big funding, but there was one question after another. I had 22 experiments in my career that were focused on the Holstein. Part of that involved vitamin E and beef quality. Overtime I had quite a bit of experience and I did a lot of outreach presentations with the packing plant and talking to farmers comparing the feeding program for a Holstein steer to that of a high producing lactating cow and really trying to educate the state and whoever would listen that it's not about forage quality, it's about energy intake. It's about getting energy into these cattle that are large-framed cattle that have considerable skeletal growth potential and getting them finished at an appropriate weight. Actually finish them with fat content on them and not looking like a male dairy cow. My industry counterpart said there were people who just fed Holstein steers along with their dry cows. They got all kinds of forage and then finally when they were 1400-1800 lbs they would sell them. They were basically unfinished cattle that the packing plant did not really want, but they took them. They were looking to make a better product. Overtime it worked and, really unknown to me, the same thing was happening in Southern California. Danny Fox was active in this realm at Cornell, but he didn't have a packing plant. We really had industry contact here and industry impact. With regards to rumen microbiology, I had an active research program for about 20 years. I just couldn't keep the funding going for the research program. I just kept teaching it and my principal student population were the dairy science graduate students in ruminant nutrition. I really served this role for the dairy science population to teach rumen microbiology. I had some great graduate students in rumen microbiology in my early years.

With regards to beef that persisted over the whole time. It was the Holstein steer and however I could help with other native cattle studies. My recognition was for the Holstein steer.

What is the favorite part of your position?

I did enjoy my teaching and my research and my phone calls from the people who would call to ask me questions, but the unexpected source of enjoyment was the advising that I did for undergraduate students and for graduate students. I came to realize that I really enjoyed getting to learn my advisees. In this department we didn't have any assigned undergraduate advisors. The undergraduate majors were distributed amongst the teaching and research faculty, and we each had a batch of undergraduate advisees that we would get to know. I got to know my advisees and they would grow from these young freshmen to now these juniors and seniors who were looking for more internship experience. I came to realize that if they had interest at all close to mine or if I extended myself to take an interest in their interest that I would know people and I could suggest internship sites for them. Or I could coach them on an academic coursework path that fit their interests and I would try to open their minds to things they could do with their animal science degree. In fact, I created a course later called "Career Orientation in Animal and Poultry Sciences". That was an outgrowth of my interaction with undergraduates. I would say that academic advising was the unexpected source of gratification.

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CAREER CALL WITH DANIEL SCHAEFER

Could you mention a few points you made to students in your career orientation course?

My strategy, of course, was based upon having a student identify their own identity. That is, I would say to a student, “What are you interested in?” And they would say, “Well, I had this experience with animals,” or if they couldn't answer the question, I would say, “Which course did you enjoy?” First of all, it presumed that they were satisfied to be in the animal sciences major. If they were satisfied in the animal sciences major, which course of those courses that they have taken was most interesting to them. They would say they really liked the that reproduction course or really liked the meat science course. If they said they really liked the beef production course, I would build on that. First of all, a student needs to know what they're interested in. The next thing I would talk to them about is speaking to people who have interests that were consistent with their interests. Do an informational interview with someone who does something that looks interesting to you and find out more about how they came to be in that path or that role. Then evaluate whether any of that information is a fit for you. I also would give them a worksheet that had a variety of characteristics of a career on it. It could be salary or financial aspects, it could be location, it could be things related to the nature of the content, etc. Some would say it was really helpful to go through and prioritize that list for themselves. They never really thought about it that way. Another thing I did is I had them read a book in this class. The book is called Who moved my cheese?. It's a very short book. It takes about half an hour to read. I would say to students that it's my kind of book. It has large font and it has pictures. The book tells a story about some mice. One mouse keeps going to the same location day after day after day and he has the cheese that he needs and he goes back home and he's very comfortable. Another mouse uses the same spot to store his cheese. He realizes that the cheese is diminishing day after day. He thinks he better think about finding another source of cheese. This is exactly what I needed to teach to our undergraduate population who were principally interested in going to vet school. They came in as freshmen and 90% of them wanted to go to vet school. I knew that upon graduation 20%, maybe 30%, of them would actually get to pursue that path. The purpose of the course was to have them think about a plan B. That's another element of career planning. Persist and devote yourself to your interests, but also be aware of whatever other opportunities might be arising. I would then have speakers come into the class and they would start by saying, “I really wanted to go to vet school when I came to this major. But then I wasn't accepted. And you know what? When one door closes, another door opens and I'm so pleased that I went through the next door.” The purpose of the course was to have students to know themselves, to know their interests, and to know what could be done with a college degree in animal science. One student wrote me a letter A to Z using each letter of the alphabet to mention a career path. They would have the sense of encouragement at the end of the course that they don't have to be a farmer, which is what their non knowing network would say to them. Animal science is much more than that. It was to offer this sense of identity and give them a sense of encouragement.

What was it like initially building your program? What helped the most?

It is about building a program when one starts out. I'll just say that later in my career when I was the department chair, I would watch this change take place in assistant professors from when they came onto the faculty to when they matured into tenured faculty members. I had to go through that same process. It was all new to me.

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CAREER CALL WITH DANIEL SCHAEFER

The step to go from being a graduate student to being a faculty member is a very large step. The magnitude of that change is underappreciated because all of a sudden, you're a professor and your graduate students or students are coming to you and they expect you to know the answer to their question. You are not that much older than they are and now you have to be right more than you're wrong. When I set about developing a course, I thought to myself that answers to questions changed overtime. So I said, "What can I teach in this course that is sufficiently certain? That is essentially a principle and I can teach this principle and the content of this principle will be reliable over the foreseeable future?" I did not emphasize teaching facts as much as I emphasized teaching principles. When I started at Purdue, I did develop a course in ruminant nutritional physiology. It was right in my ruminal microbiology/ruminant nutrition interest. I had to organize my thoughts and eventually I thought it would be really cool if I got to the end of the course and I could say to the class on it final exam, "There's carbon in cellulose. Tell me about the transformations of that carbon and cellulose to become the carbon in butyrate used for fatty acid synthesis in milk." There's a lot of transformations that go on there, but that's the way I try to tie things together. When I taught ruminal microbiology, I used Hungates questions. Who were the organisms? What are their activities? What are the interactions among those organisms? But then I taught it from the level of polymers that come into the rumen to monomers that are produced from those polymers to the metabolism of those monomers to the energy yield from those monomers. Oh, and by the way, we have to keep track of electrons. In beef production I wasn't teaching reproduction. I wasn't teaching breeding. I don't claim to be strong in genetics and so I always had someone co-teach with me who's really good at genetics. But my job was from calf to cow to finished animal. All of the management that went in between there. The resources were just a lot of reading. I did a lot of reading. I still read industry magazines. That's how I learned how to put the beef production course together. I was always involved in the literature as a reviewer and writer. That's where that really concrete knowledge came from. I was taught by my students. My students would learn things and if I could grasp what they were telling me, I thought I ought to integrate that into my working knowledge. I learned things from my students. I was in school. We are all in school our entire life. We are just always growing and if we're not growing, we will be known as dead wood.

What is your favorite food?

My favorite food is the fish halibut eaten in Alaska. I had halibut in Alaska, and it was outstanding. But you have to go to Alaska. I think it is freshest there. Wow, it was good. It was great.

What type of music do you usually listen to?

It's always been country Western. Well, at least in my later years now. For a long time I didn't have time to listen to the radio, but now it's country Western.

What is something you know now that you would want to go back and tell your younger self?

I think that postdoctoral experience is very important. It was important when I was younger. It's more important now. For a master's degree, a student learns the process of research. They're pretty much plugged into a project.

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CAREER CALL WITH DANIEL SCHAEFER

For a PhD degree, the project is less well-structured and the student needs to learn how to now generate new knowledge. In a post Doc, one further develops the tools in their toolbox. Either a deeper set of tools or a broader set of tools that will be used to generate new knowledge. I think the postdoc gives a person longevity in a research career. It delays one's entry into the wage-earning workforce and there are financial reasons in that regard to not do a postdoc. I think that doing a postdoc for 10 years is wrong. I'm not advocating for that. I think one year, or two years, of post doc experience has a very good cost benefit ratio.

What is your CattleCal top tip?

I'm a fan of thriller movies. Nothing that's particularly gory or anything. I'm a Harrison Ford fan. He would be my favorite actor and I have enjoyed many of his movies. I particularly liked his movie The Fugitive. It's a great movie. I listened to him on a late-night talk show when he was being interviewed and he said something that resonated with me. He said that everyone should find success according to their own definition. Success is not the same from person to person. I thought that was really good because it speaks to the fact that we should apply ourselves to the best of our ability and we don't have to do it according to someone else's standards or someone else's definition. We just work at applying our skills, talents, abilities, and interests and it becomes what it becomes. That is what we should be satisfied with.

How can our listeners contact you?

Email: schaeferd@ansci.wisc.edu

Photo: Dan Schaefer with children, Mary and Jeremy Schaefer.

RESEARCH CALL WITH DANIEL SCHAEFER

This week we are speaking again to Dr. Dan Schaefer about his work with the effect of vitamin E supplementation on meat color of beef cattle.

Could you just tell us a little bit of background about vitamin E and meat color and how you stepped into this?

This was a highlight of my career. I began my research career at the University of Wisconsin. I began to do research with Holstein steers and methods for appropriately finishing Holstein steers. At one point, the company known as Hoffman LaRoche, which is now known as DSM Nutrition, came to me because they inquired whether I could do a vitamin E project. They were concerned about liver abscesses in Holstein steers, and they thought that perhaps there was some linkage between rumen wall health and liver abscesses. Vitamin E had the reputation of being an important component of a healthy epithelium. They were interested in the effect of vitamin E on the rumen epithelium. Furthermore, they had, through their literature review, determined that the vitamin E content of high moisture shelled corn was relatively low, and diets that were high in high moisture shelled corn would have a relatively low endogenous intake of alpha-tocopherol. They came to me because I was feeding high moisture shelled corn with the concentrate portion being 90% of the diet and 10% corn silage to finish Holstein steers. I was started down into that project and we were going to slaughter Holstein steers at 1000, 1100, and 1200 pounds. This project took place between 1987 to 1988.

About that time I was having communication with a man named Norval Dvorak, who was a vice president in charge of business development and market growth for Packerland packing company in Green Bay, WI. He was telling me for several years they had been harvesting high-energy fed Holstein steers and trying to open new retail markets for that beef product. When they would go into stores and put their Packerland beef, which was derived from Holstein steers, out alongside of these cuts steaks the other native cattle packers were also setting out in their display cases, the color would not hold as well. The fresh beef color does not remain as durable in the Packerland steaks as it is in steaks from these other competitor companies. He was asking me what could cause that. I put my thinking cap on. I really didn't have an answer for him in that phone call, but when I hung up the phone I just thinking to myself about what could be going on. So I knew from my meat science background that the color change from oxymyoglobin to metmyoglobin is an oxidation of the iron molecule in metmyoglobin from ferrous to ferric. There's an oxidation step. Well, if that's an oxidation step, I really ought to think about whether there's anything that could delay that oxidation. What do I know about antioxidants? Vitamin E is an antioxidant. It's a free radical scavenger. I'm doing a vitamin E project right now. I went to my meat science faculty colleagues and I was thinking about whether one could feed vitamin E, whether it would be deposited in the muscle, and whether it could function in delaying the oxidation of oxymyoglobin to metmyoglobin. Their answer was, “I don't know. Never heard of that idea.” The meat science extension faculty member, Dennis Buege, came to me one day. He came back to me and asked if we would be getting steaks out of the Holstein steers. And I thought I would try that. I had never gotten cuts out of a packing plant from cattle.

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RESEARCH CALL WITH DANIEL SCHAEFER

That was not anything that was commonly done back in the 80's. I called the packer and they confirmed that they could get me ribs. How are we going identify them from live animal to the fabrication room? Well, we had to figure that out. And we did. We came back with these steaks. We were harvesting cattle at a constant 1000, 1100, 1200 lbs. We got the ribs back and aged them for 14 days postmortem. We cut strip steaks out of those striploins. I had an undergraduate student whose name was Chris Scheller. She was a dishwasher in my lab, but she was very interested in in beef quality. I told her that first we're going to cut these steaks. We had to set up some lights here and we have to make retail conditions. We're put these steaks out in trays and over wrapped them in PVC film. We put them out like it's a retail condition. I told her to go over there every day and write down the percent discoloration on those steaks. I didn't disclose the treatments to her. She came to me one day and she said that something's going on over there with those pens of cattle. I had her show me her data. She showed me her data sheet, animal numbers, percent discoloration. I pulled out my sheet of animal numbers, pens, and treatments. There was something there. At the end of that day, I went over to the meat lab and I looked at the steaks. I was like, "Wow, this is pretty obvious. I think there's something here." I went home that night and at supper I said to my family, "I think I made a discovery today." And their reaction was, "Pass the potatoes."

We began to take pictures of these steaks to capture this. Originally I was supposed to measure rumen papillae length. As we took these steers through slaughter at Packerland, there were no liver abscesses. We looked at the rumen walls. We looked at both sides of the rumen. We looked at the epithelial side, and we looked at the serosal side. I reasoned, if there's some penetration of the rumen wall, you would think that's going to cause some inflammation on the serosal side of the rumen. When you're looking at the serosal side of the rumen and you've got red against white, it ought to be so much easier to see than looking for ulcerated papillae that are clumped in the rumen. You can do both, but there were no liver abscessed. There were occasional liver abscesses, but there was no problem. I wasn't replicating the problem that Hoffman LaRoche was intending to investigate. I called them and told them that I think there's a vitamin E effect on the color shelf life. Well, I may not have used that fancy word at the time. They asked if I meant fewer dark cutters. No, I was talking about the length of time that fresh beef holds its bright red, desirable color. They had to come and see it. I did an abstract in animal science meetings, presented it at Laramie, WY. In the audience was Gary Smith from Colorado State. Gary Smith would tell me later that he said to his wife after that talk as they were leaving animal science meetings, he said he went to listen to this talk and there was this guy who was putting this little, bitty amount of vitamin E into the finishing diet of cattle. That it was having this dramatic effect on color, shelf-life stability. He thought it was just so amazing. I developed the body of knowledge on this topic. At the time I was the dominant force in refereed publications on this topic. Gary Smith became my marketing arm. Gary Smith is the one who had recognition in the beef industry. He was so proud to promote this piece of technology that had economic impact. Eventually we did a study with Keith Belk, who's now a senior guy in meat science at Colorado State. Keith was just a graduate student at the time, and we did a marketing study to Japan. We had done in store studies here in the US in a in a big project called the Strategic Alliance field study.

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Then we did it in a study with beef that was from control and vitamin E fed steers that was shipped to Japan. Overall, we could see that the value to the retailer was about $30 ahead and the cost of the vitamin D was about $3 a head. There was an economic benefit.

There was a challenge with it, though. That challenge was how we would be sure that the animals were being fed and consuming the vitamin E. We never could figure out a rapid test for vitamin E in muscle tissue. We had an HPLC method that worked great if you had enough time to do it. To do something in the cooler that would confirm vitamin E content of tissue was something we didn't solve.

The only way the technology came to be used and implemented in the industry is when there were vertically acting business relationships where there was a relationship between the feet lot, the packing plant, and the retailer. In the early going, there were a chain of stores in Southern California called Ralph's. Ralph's was purchasing Holstein steers out of Southern California and Arizona going through the Sunland plant in Tolleson, AZ. Ralph's, then under the leadership of a man by the name of Charlie Bird, was buying Holstein beef out of the Sunland plant and marketing into it into Ralph's. He used it and then Harris Ranch in Coalinga, CA became a user of it. They actually became the last and longest user of the technology. I'm not sure if they're still using it or not, but they were a cattle feeder, they were a packer, and they had retail outlets. The structure of the current industry, which is segmented, did not really fit the technology because it's the cattle feeder that bears the expense and it's the retailer who realizes the benefit. In a segmented industry, it's difficult to get the segments to communicate in business relationships. One retailer said to us in a meeting that the technology sounded good, but didn't want vitamin E supplemented beef from just one packing plant. They needed to have at least two sources so that they can have competitive pricing. They didn't want to get cornered by one packer. The structure of the industry became antagonistic to the technology, but I was satisfied because I knew that the technology had value. There is no better way to introduce an antioxidant into beef than by doing it through the diet so that the antioxidant is correctly positioned at the cellular location where it is most effective. That is in the cell membrane, and that's what feeding vitamin E is successful as opposed to any post-harvest surface application. I think vitamin E is a fantastic model and it was a great discovery. I got a lot of satisfaction from that. I had some great postdocs who helped me work on that, had some great content with graduate students. Traveled, published. For a phase in my career, I had appropriate funding so that I could do one question after another.

Is there is specific time cattle need to be fed Vitamin E for it to be effective for meat color?
We did the dose titration trials with different dosages of vitamin E for different durations of time. I can say that it takes about 100 days for the muscle alpha tocopherol concentration to come into equilibrium with the dietary concentration. An administration of 500 international units of supplemental vitamin E, typically given as alpha tocopherol acetate (which is 1 IU per milligram of alpha tocopherol acetate) for the last 100 days will about double the color display life of fresh beef cuts. The muscles have different display lines. The tenderloin has a very short color display life.

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In this case, vitamin E supplementation might double the color display life from two days to four days. For the longissimus, it might double it from 3.5 to 7 days. The gluteus medius is somewhere in between there. We evaluated it in Holstein steers and we also evaluated it in native crossbred beef steers. It's the same for both. It's a cattle-wide principle.

Do you see a future for vitamin E in the cattle industry given how segmented the industry is?
I see a future only where the segments begin to act in a vertically coordinated manner. I would have to say that in those early years in the 1990s the meat industry was particularly concerned about doing preharvest improvements to cattle. Since that time, BQA (Beef Quality Assurance) come on the scene, there now is a little more attentiveness by packers to preharvest management of cattle. Vitamin E also may not be a sufficient technology to cause vertical coordination, but it can be a component and it can be one of the beneficial technologies that gets inserted into a coordinated program. I don't know whether it will take hold again, but it's quite interesting now in these times as the beef on dairy topic is very popular. If you listen to Dale Woerner from Texas Tech, he will talk about the fact that they show that the color display life of the straight Holstein is less than the color display life of natives and less than the beef on dairy crossbreds. He has a larger data set than I had, so I'll accept that answer from him.

Are there any other methods of supplying vitamin E instead of feeding?
No, not to my knowledge. I evaluated vitamin C because there's a there's a synergism between vitamin C and vitamin E in that ascorbic acid can regenerate oxidized Vitamin E, but vitamin C is not retained. There is no conservation of ascorbic acid in ruminant metabolism. It is produced in sufficient quantities by the animal, but it is not really conserved or stored. Vitamin C doesn't help the situation. We did a project with high tannin sorghums. We expected the tannin to actually cause oxidation in beef. What happened was just the opposite. There was some beneficial effect of tannins. The antioxidant story in muscle tissue is complicated and not all that well understood. We surveyed cattle just in the routine slaughter of that Packerland Holstein steers that were coming in from a variety of sources. I presumed that very few of these cattle were coming in having had vitamin E supplementation. We were working on a rapid assay for antioxidant status of muscle. We were introducing a challenge of oxidants into a minced meat solution of a slice of the neck muscle exposed upon decapitation. What we found is that the antioxidant capacity of these steers was widely variable. We also related this to alpha tocopherol concentration in the muscle. When we plotted the data, it was just a scattergram. Increasing tocopherol did result in less oxidation of these muscle suspensions, but at low tocopherol there was highly variable response to oxidation status. There could be some animals with low tocopherol that had very little oxidation. Others that had very high oxidation. There must be a variety of compounds in the diet of cattle that play a role in antioxidant status. We just don't know what they are.

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Were there any other benefits to supplementing vitamin E other than increased meat color?
There was a faculty member at Washington State, Boon Chew, who was publishing some work indicating that vitamin E was having beneficial effects on immune system in in cattle, especially in newly received calves in the feedlot setting. Bill Weiss at Ohio State was doing some work on vitamin E and mastitis. I felt like the literature was more certain that there was a beneficial effect of supplemental vitamin E on somatic cell count from the mammary gland. The relationship between vitamin E and health status in newly received cattle was less clear. My answer to your question is that vitamin E and the immune system is another candidate area. My background in bovine immunology was not good enough to really understand that and to be able to dissect that. In terms of just growth and performance, there's nothing there.

One other thing that I just wanted to mention is that I think the interdisciplinarity of our thought process is very important. What I mean by that is that because of this color change, the oxidation of oxymyoglobin to metmyoglobin is a redox reaction. Typically, in ruminant nutrition, we don't think in terms of redox reactions that much. We're a lot more about the energy side: ATP generation and proper carbohydrate sources. My role in a microbiology background had tuned me up through redox reactions and thinking about oxidation. Especially reducing agents, which we add to the medium to cultivate rumen bacteria. I had this working knowledge of redox reactions, which made my thought process relative to my goal much more comfortable to me. I don't think I could have had the vitamin E meat color idea without my appreciation for the culture of anaerobes. It wasn't a very sophisticated idea. When I finally settled into it there was evidence of it in the literature before that, it just hadn't been put together the way my experiment put it together.

Photo: Difference in color of steaks after 7 days in the display case for cattle supplemented vitamin E (left) and cattle not supplemented with vitamin E (right).

FEEDLOT RESEARCH BRIEF

Effect of FFA in supplemental fat on growth performance of calf-fed Holsteins in the feedlot

Introduction

- Griddle grease is fat that is caught in grease traps in food preparation areas.
- Yellow grease is leftover cooking oil from fryers and griddles.
- Griddle grease has a higher FFA content.
- A mixture of griddle grease and yellow grease will result in a product with higher FFA content than just yellow grease.
- The goal of this study was to determine the influence of increasing FFA content on the feeding value of yellow grease in finishing diets for feedlot cattle.

Methods

- 96 Holstein steers (~825 lbs) were blocked by weight for a 144 day feeding trial.
- Blocked by weight into 16 pens (6 steers/pen)
- Treatments:
  1. Control - no supplemental fat
  2. 5% supplemental griddle grease (42% FFA)
  3. 2.5% supplemental griddle grease + 2.5% conventional yellow grease (28.5% FFA)
  4. 5% conventional yellow grease (15% FFA)
- 88% concentrate diet (corn + barley)

Results

- Overall, supplementing fat:
  - Increased ADG (11%), feed efficiency (9%), and dietary NEm (6.4%).
  - No change to DMI.
- During the first 56 days on feed, fat supplementation increased DMI (8.2%).
- Increasing FFA content increased DMI, ADG, and feed efficiency.
  - Due to increased diet acceptability.
- Fat supplementation increased carcass weight (4%), dressing percentage (1%), and KPH fat (20%).
- Increased FFA content decreased retail yield.
- Feeding value of griddle grease and yellow grease are similar
- Did not affect digestion.

Item	0% Fat	Supplemental fat, % FFA[a] 42.0	28.5	15.0
Ingredient composition, % (DM basis)				
Alfalfa hay	6.00	6.00	6.00	6.00
Sudangrass hay	6.00	6.00	6.00	6.00
Steam-flaked barley	39.80	39.80	39.80	39.80
Steam-flaked corn	39.80	34.80	34.80	34.80
Griddle grease	—	5.00	2.50	—
Yellow grease	—	—	2.50	5.00
Cane molasses	5.00	5.00	5.00	5.00
Urea	1.00	1.00	1.00	1.00
Limestone	1.70	1.70	1.70	1.70
Trace mineral salt[b]	.50	.50	.50	.50
Magnesium oxide	.20	.20	.20	.20
Monensin[c]	+	+	+	+
Nutrient composition, DM basis[d]				
NE, Mcal/kg				
Maintenance	2.01	2.19	2.19	2.19
Gain	1.36	1.52	1.52	1.52
Crude protein, %	13.9	13.4	13.4	13.4
ADF, %	8.4	8.4	8.4	8.4
Lipid, %	2.8	7.5	7.5	7.5
Calcium, %	.85	.85	.85	.85
Phosphorus, %	.33	.33	.33	.33
Magnesium, %	.28	.28	.28	.28

Implications

Differences in FFA content of yellow grease will not negatively affect diet acceptability or growth performance of feedlot cattle.

CONTACT

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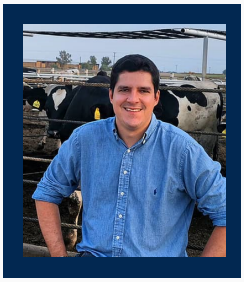

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