

# K News from KSU Animal Sciences

- ✉ **It is not too late to attend the 2022 KSU Swine Day.** The 2022 KSU Swine Day will be hosted Thursday, November 17, at the KSU Alumni Center. The complete schedule and updated information can be found at [www.KSUswine.org](http://www.KSUswine.org). For more information, contact Lois at [lschrein@ksu.edu](mailto:lschrein@ksu.edu) or 785-532-1267.
- ✉ **Kansas 4-H EID Livestock Tag Orders** - Kansas 4-H EID Livestock Tag Orders are now open and can be submitted to the KSU Youth Livestock Program. All market animals or commercial females that will be nominated for the 2023 Kansas State Fair Grand Drive and/or Kansas Junior Livestock Show (KJLS) must be tagged with an official Kansas 4-H EID tag. Market beef tag orders are due by December 15, 2022, with small livestock tag orders being due January 15, 2023. We are hoping the supply chain issues have been resolved for the tag manufacturers and things will go more smoothly this year. The order forms and other tagging resources may be found on the KSU Youth Livestock Program, under the EID Tags tab (<https://www.asi.k-state.edu/extension/youth-programs/nominations/kansas-4-h-eid-tags.html>). All of the new meat goat tags ordered this year will be the round meat goat tags that were piloted in 2021. If you still have some ribbon tags left, you may still use them, as either type will be accepted for state livestock nomination. Payment is required to accompany the completed order form for it to be accepted. Extension Units must designate an agent to be responsible for their tags, as well as keep records of the families and animals in which each tag is applied. For those units who would like to order all of their tags at once, one check reflecting the total amount can be issued. However, both forms must be completed and mailed with the check. For more information, contact Lexie Hayes at [adhayes@ksu.edu](mailto:adhayes@ksu.edu) or 785-532-1264.
- ✉ The **2023 K-State Swine Profitability Conference** has been scheduled for Tuesday, February 7, 2023, at the Stanley Stout Center, Manhattan, KS. Watch for more details coming soon at [www.KSUswine.org](http://www.KSUswine.org).
- ✉ **Make plans to attend Cattlemen’s Day 2023** - The 110<sup>th</sup> annual Cattlemen’s Day will be hosted Friday, March 3, 2023. The trade show and educational exhibits will open at 8 a.m. in Weber Arena.  
Registration for KSU Cattlemen’s Day will be \$20 per person in advance or \$30 per person at the door. Morning refreshments and lunch are included with registration. A complete schedule will be coming soon to [www.asi.ksu.edu/cattlemensday](http://www.asi.ksu.edu/cattlemensday) or call 785-532-1267.  
If you are interested in exhibiting at Cattlemen’s Day or have any questions, please contact Dale Blasi ([dblasi@ksu.edu](mailto:dblasi@ksu.edu); 785-532-5427).
- ✉ The **46<sup>th</sup> Annual Legacy Bull and Heifer Sale** will be March 3, 2023, at 4:00 p.m. at the Stanley Stout Center. Visit [www.asi.k-state.edu/about/services/legacy/](http://www.asi.k-state.edu/about/services/legacy/) for more information, as it becomes available, including the sale catalog.

Department of Animal Sciences and Industry  
 Kansas State University  
 218 Weber Hall, 1424 Claflin Road  
 Manhattan, KS 66506  
 785-532-6533  
[www.asi.ksu.edu](http://www.asi.ksu.edu) - Facebook.com/KSUASI

November 2022 issue



# UPCOMING EVENTS...

↪ The **2023 K-State Junior Producer Day** dates have been set! We are excited to host families on campus again this spring. The K-State Junior Swine Producer Day will be Saturday, March 11, with K-State Junior Meat Goat Producer Day scheduled for Saturday, March 18. Both events will be hosted in Weber Hall on the K-State campus in Manhattan. These events are one-day educational events for families to learn more about the selection and management of a specific specie. Youth, adults, extension agents, project leaders, and volunteers of all ages and skill levels are invited to attend! Presentations will be provided by K-State faculty, staff, students, extension agents, and guest speakers. Topics range from selection, to nutrition, to meat science, reproduction, health, clipping and grooming, and showmanship. Everyone who plans to attend must register, including both youth and adults. The cost is \$20/person by the deadline, or \$25 after the deadline for both events. Only those who register by the appropriate deadline will receive a t-shirt. Junior Swine Producer Day registrations are due February 15, with Junior Meat Goat being due February 22. Registration is open now and can be completed using this link: <http://bit.ly/ksuasiregister>.

An optional YQCA instructor-led training and state livestock nomination session will be offered at the end of each program. More details about the junior day events are available on the @ksuylp Facebook page and the KSU YLP website: <https://www.asi.k-state.edu/research-and-extension/youth-programs/ks-jr-producer/index.html>. For more information, contact Lexie Hayes at [adhayes@ksu.edu](mailto:adhayes@ksu.edu) or 785-532-1264.

↪ **IRM Redbooks for Sale** – The 2023 IRM Redbooks are here and will be sold on a first come, first-serve basis. The price is \$6.50/book for orders of ten or more; \$6.75/book for orders of less than 10 which includes postage. To order your supply of Redbooks, please contact Lois Schreiner ([lschrein@ksu.edu](mailto:lschrein@ksu.edu); 785-532-1267).

↪ Watch the **KSU ASI Headlines** for October 2022 and find out the latest happenings in the department. Follow the link at <https://youtu.be/7sXCRkf7gdw>. For questions about the department, contact Dr. Mike Day, ASI Department Head, at 785-532-1259; [mlday@k-state.edu](mailto:mlday@k-state.edu).

## CALENDAR OF UPCOMING EVENTS

Date	Event	Location
November 17, 2022	KSU Swine Day	Manhattan
February 7, 2023	K-State Swine Profitability Conference	Manhattan
March 3, 2023	KSU Cattlemen's Day	Manhattan
March 3, 2023	Legacy Bull and Heifer Sale	Manhattan
March 11, 2022	K-State Junior Swine Producer Day	Manhattan
March 18, 2022	K-State Junior Meat Goat Producer Day	Manhattan

# WHAT'S NEW...

**Management Minute** – Justin Waggoner, Ph.D., Beef Systems Specialist

## *“Responsibility and Accountability – Who Opens the Gate?”*

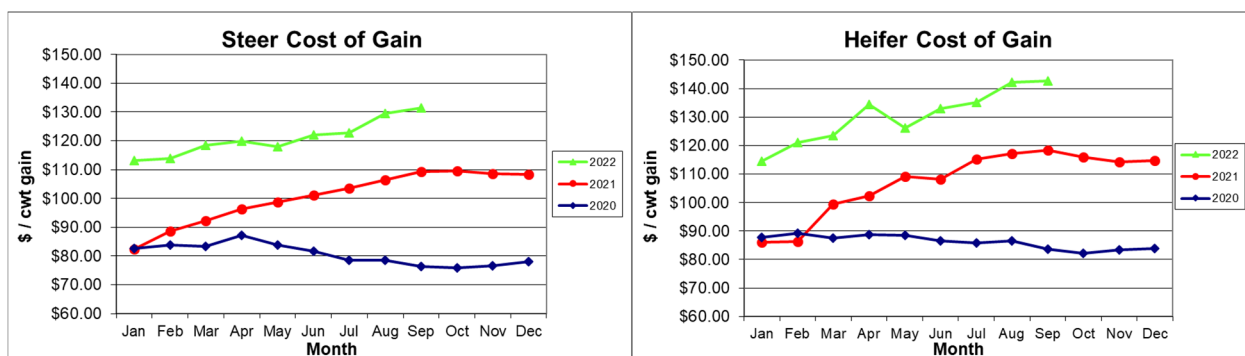
All organizations and businesses regardless of size struggle with clearly defining responsibilities and accountability in one way or another. There is an old saying “when everybody is responsible, nobody is responsible.” The underlying theme of this saying is that expectations or responsibilities must be clearly defined and communicated to be effective. Effectively communicating responsibility involves the following: 1). Determining who is responsible, 2). What they are responsible for, and 3). Confirming that they are willing to accept the stated responsibility. Agriculture offers some great examples of responsibility and accountability. In the livestock sector, if you are riding in the passenger seat of vehicle as you approach a gate it is your responsibility to open the gate. One could debate if the responsibility is effectively communicated (sometimes non-verbal). Whose responsibility is it close the gate? The same person who opened the gate. Should the gate not get closed, and the livestock escape who is accountable for not closing the gate? The person who opened it.

For more information, contact Justin Waggoner at [jwaggon@ksu.edu](mailto:jwaggon@ksu.edu).

**Feedlot Facts** – Justin Waggoner, Ph.D., Beef Systems Specialist

## *“Cost of Gain in Kansas Feedlots”*

One of the more common questions I have addressed recently is “What is the current cost of gain in feedyards?” The September edition of the Kansas State University Focus on Feedlots reported an average cost of gain of \$131.34/cwt for steers and \$142.78/cwt heifers marketed in September. The average reported projected cost of gain for cattle placed on feed in October was \$144.20/cwt for steers and \$150.60/cwt. for heifers. The figures below illustrate feedlot cost of gain for steers and heifers from 2020, 2021, through September, 2022. Cost of gain for both steers and heifers has steadily increased since January/February of 2021. The highest reported cost of gains for steers and heifers in the Focus on Feedlot data (Jan. 1990-present) occurred in March 2013 (\$133.72/cwt. for steers and \$136.76/cwt. for heifers). Thus, the average reported cost of gain for heifers in August (\$142.18/cwt.) and September (\$142.78/cwt), 2022 have now become the highest cost of gains reported in the Focus on Feedlot data.



For more information, contact Justin Waggoner at [jwaggon@ksu.edu](mailto:jwaggon@ksu.edu).

☞ **Animal Technician II** – (Dairy Unit; Job #513995) – This is a full-time, University Support Staff position. This position exists to milk, feed, and provide care of the Dairy Teaching and Research Center (DTRC) dairy herd, which is used for teaching and research purposes. Review of applications begins immediately and continues until a candidate is identified. For more information, contact Dr. Mike Brouk, Search Committee Chair, at [mbrouk@ksu.edu](mailto:mbrouk@ksu.edu) or 785-532-1207. To apply, go to <https://careers.k-state.edu/cw/en-us/job/513995/animal-technician-ii>.

# WHAT'S NEW...

➤ **Exploring the Potential Effect of Phospholipase A2 Antibody to Extend Beef Shelf-Life in a Beef Liposome Model System** - The objective of this study was to utilize a beef liposome model system to investigate if phospholipase-A2 antibody (aPLA2) can be used to inhibit phospholipase-A<sub>2</sub> (PLA2) activity to potentially improve beef shelf-life. Phospholipids (PL) from 10 U.S. Department of Agriculture choice beef striploin steaks were extracted and split into six treatments: PL (25 mg of PL); aPLA10 (PL + 25 µg of aPLA2); aPLA20 (PL + 50 µg of aPLA2); PLA2 (PL + 10 µg of PLA2); PLA2+aPLA10 (PL + PLA2 + aPLA10); and PLA2+aPLA20 (PL + PLA2 + aPLA20). The model system was under retail display at 39°F and 2300 lux for 7 days. At day zero, aliquots were taken for PL profiling and product ion analysis. At days 0, 1, 4, and 7, aliquots were taken for lipid oxidation analysis. At day 7 of display, PLA2, PLA2+aPLA10, and PLA2+aPLA20 treatments had greater lipid oxidation compared to the samples without PLA2. This trend was seen in the other retail display periods. Interestingly, day-7 aPLA10 and aPLA20 had less lipid oxidation than day-7 PL and less oxidation than day-4 PLA2. The PL profile analysis showed clear differences between treatments with or without the addition of PLA2. The PLA2 treatments showed greater relative percent of total PL degradation products than treatments without PLA2. The PLA2 treatments had less relative percent of total ether-linked phosphatidylcholine (ePC) than treatments without PLA2. It appears that aPLA2 had no effect on inhibiting PLA2 hydrolysis as there was no difference between PLA2 and aPLA+PLA2 treatments in relative percent of total ePC, phosphatidylcholine (PC), or in PL degradation products.

**The Bottom Line:** Phospholipase-A<sub>2</sub> significantly alters beef phospholipids to a composition that is potentially susceptible to lipid oxidation. At day-7 of retail display, there is significant lipid oxidation from PLA2 added treatments, yet the aPLA2 only treatments seem to present an antioxidant effect. Effectively inhibiting PLA2 activity can potentially improve beef shelf-life stability. More information is available on this experiment and others in the KSU Cattlemen's Day report at [www.KSUbeef.org](http://www.KSUbeef.org). For more information, contact Michael Chao (785-532-1230; [mdchao@ksu.edu](mailto:mdchao@ksu.edu)) or Liz Boyle (785-532-1247; [lboyle@ksu.edu](mailto:lboyle@ksu.edu)).

➤ **Digestibility of Dry Matter is Better and Manure Output is Lower in Growing Cattle Limit-Fed a High-Energy Diet During the Growing Phase Compared to a Traditional Roughage-Based Diet Fed for *Ad Libitum* Intake** – The objective was to evaluate the impact on intake and digestion of a high-energy diet limit-fed at 85% of the *ad libitum* daily consumption of a roughage-based diet on a dry matter (DM) basis compared to a traditional roughage-based growing diet in growing cattle. Eight ruminally cannulated crossbred Angus heifers were used in a cross-over design with two consecutive 15-day periods at the Kansas State University Beef Stocker Unit. Two dietary treatments were fed: (1) 45 Mcal of net energy for gain (NEg) per 100 lb of DM fed for *ad libitum* DM intake (45AL), or (2) 60 Mcal NEg per 100 lb of DM limit-fed at 85% of 45AL diet intake on a DM basis (60LF85%). Both diets contained 40% of DM as Sweet Bran. Heifers were fed once daily at 10:00 a.m. Each 15-day period included 10 days for diet adaptation, four days for fecal sampling, and one day for ruminal sampling. Daily nutrient intake was measured and apparent total-tract diet digestibility using chromic oxide (Cr2O3) marker was determined. Ruminal pH was greater from 10:00 p.m. to 10:00 a.m. just before feeding for heifers fed 60LF85% than 45AL heifers. Diet digestibility was improved by 5.2% and fecal DM output 35% lower in heifers fed 60LF85% than heifers fed 45AL.

**The Bottom Line:** Heifers limit-fed a high-energy diet based on corn and Sweet Bran had greater ruminal pH during the overnight hours, better diet digestibility, and reduced output of manure than heifers full-fed a traditional roughage-based diet. More information is available on this experiment and others in the KSU Cattlemen's Day report at [www.KSUbeef.org](http://www.KSUbeef.org). For more information, contact Dale Blasi (785-532-5427; [dblasi@ksu.edu](mailto:dblasi@ksu.edu)).

➤ **Evaluation of Biosecurity Measures on a Commercial Swine Operation Using Glo Germ Powder as a Visible Learning Aid** - Glo germ, a fluorescent powder, was used to determine the efficacy of common biosecurity practices to prevent the powder from spreading to other areas within a commercial swine farm. The areas tested included an entry bench, the shower where all incoming personnel are required to shower upon farm entry and exit, the clean area following the shower, and inside the barn, which acted as the control with no biosecurity procedures in place given it is fully contained within the broader biosecurity measures of the facility. Pictures, from a standard iPhone, were taken before and after student and personnel movement to observe any differences in Glo Germ coverage.

# WHAT'S NEW...

The percentage of Glo Germ coverage in the before and after pictures was evaluated once by forty-seven untrained panelists and averaged for each location and time point. The control area with no biosecurity measures in the barn had significantly more Glo Germ coverage than the other three locations. There was no evidence of a difference in Glo Germ coverage between the entry bench, shower floor, or clean side of shower. In conclusion, the use of Glo Germ was successfully able to emulate disease entry into the farm and can be used as a learning aid to demonstrate the efficacy of entry benches, clean/dirty lines, and showers. More information is available on this experiment in the KSU Swine Day report at [www.KSUSwine.org](http://www.KSUSwine.org). (This study conducted by Olivia Harrison, Payton Dahmer, Jordan Gebhardt, Chad Paulk, Jason Woodworth, and Cassandra Jones.)

↪ **Effects of the Pelleting Process on Diet Formulations with Varying Levels of Crystalline Amino Acids and Reducing Sugars on Nursery Pig Growth Performance** - Pelleting swine feed and the use of crystalline amino acids and by-product ingredients can potentially create ideal conditions that further facilitate the Maillard browning reaction. The Maillard reaction combines an amino group of a free amino acid and a carbonyl group of a reducing sugar (RS), making the amino acid less available. The objective of this study was to determine the effects of pelleting swine diets containing free amino acids and reducing sugars at high temperatures on nursery pig growth performance. A total of 360 were used in a study evaluating the effect of crystalline AA, reducing sugars, and feed form on growth performance of nursery pigs. Treatments were arranged in a  $2 \times 2 \times 2$  factorial with main effects of crystalline AA concentration (low vs. high), reducing sugars (RS; low vs. high), and diet form (mash vs. pellet). Diets were formulated with low or high crystalline AA and low or high reducing sugars provided by co-product ingredients, DDGS and bakery meal. Diets were pelleted to a conditioning temperature of 187.5°F. When pigs weighed approximately 25 lb, they were weighed, and pens were randomly assigned treatments. There were nine replications per treatment and five pigs per pen. There were no three-way or two-way interactions. For the main effect of form, there was no evidence of difference in ADG, and ADFI increased in pigs fed mash diets compared to pellets. Feed efficiency and caloric efficiency improved in pigs fed pelleted diets compared to mash diets. For the main effect of crystalline AA, there was no evidence of difference in ADG or F/G; however, pigs fed high crystalline AA had increased ADFI compared to those fed low crystalline AA diets. For the main effect of RS inclusion, pigs fed low RS diets had increased ADG and ADFI compared to pigs fed high RS inclusion diets. There was an improvement in F/G and caloric efficiency for pigs fed high RS inclusion diets compared to those fed low RS diets. There was no evidence of difference in IOFC for form, crystalline AA, or RS. In conclusion, there was no evidence of interactions between diet types, indicating that increasing amounts of crystalline AA and RS did not increase the Maillard reaction or reduce growth performance when pelleting diets by using the reported conditions. Pigs fed pelleted diets had similar ADG and an 8% improvement in F/G compared to those fed mash diets. Pigs fed the high RS diets had reduced feed intake, which resulted in reduced gain and improved feed and caloric efficiency. Additionally, pigs fed high AA diets had increased feed intake. More information is available in the KSU Swine Day report at [www.KSUSwine.org](http://www.KSUSwine.org). (This study conducted by Kara Dunmire, Michaela Braun, Yiqin Zhang, Cassandra Jones, Yonghui Li, Jason Woodworth, Robert Goodband, Mike Tokach, Adam Fahrenholz, Charles Stark, and Chad Paulk.)

↪ **Effects of Standardized Ileal Digestible Lysine Level on Growth Performance in 230 to 285 lb DNA Finishing Pigs** - The objective of this study was to estimate the SID Lys requirement for growth and feed efficiency of 230- to 285-lb DNA finishing pigs. A total of 679 barrows and gilts were used in two separate studies lasting 21- and 28-d, respectively. Pens of pigs were blocked by BW and randomly allotted to one of six dietary treatments with 8 to 10 pigs per pen in a randomized complete block design. A similar number of barrows and gilts were placed in each pen. Dietary treatments were corn-soybean meal-based and formulated to 0.43, 0.50, 0.57, 0.64, 0.71, and 0.79% SID Lys, with twelve replications for the 0.43, 0.50, 0.57, 0.71, and 0.79% SID Lys treatments, and eleven replications for the 0.64% SID Lys treatment. Increasing SID Lys increased ADG, and improved feed efficiency, resulting in pigs fed the diet containing 0.71% SID Lys having the greatest final BW and most optimum F/G. At high and low ingredient and pig prices, increasing SID Lys increased IOFC. The broken-line linear model to maximize ADG predicted that there was no further improvement past 0.64% SID Lys. For F/G, the broken-line linear model predicted that there was no further improvement past 0.59% SID Lys. At high ingredient and pig prices, the quadratic polynomial model for IOFC predicted maximum economic return at 0.64% SID Lys. Additionally, at low ingredient and pig prices, the quadratic polynomial model for IOFC predicted maximum economic return at 0.62% SID Lys. In summary, the optimal SID Lys level for DNA finishing pigs from 230- to 285-lb depends upon the response criteria, with growth performance maximized between 0.59 to 0.64% SID Lys. Economic responses were maximized between 0.62% SID Lys and 0.64% SID Lys. More information is available on this experiment the KSU Swine Day report at [www.KSUSwine.org](http://www.KSUSwine.org). (This study conducted by Rafe Royall, Robert Goodband, Mike Tokach, Joel DeRouche, Jordan Gebhardt, and Jason Woodworth.)

# ASI FACULTY SPOTLIGHT...



**Michael Chao ([mdchao@k-state.edu](mailto:mdchao@k-state.edu); 785-532-1230)**  
**Assistant Professor, Meat Science**

Dr. Michael Chao is a meat scientist with research interests in meat lipidomic and developing niche meat processing techniques to serve the needs of domestic-ethnic and international markets.

Michael grew up in Taiwan until the age of 15, when his family moved to the Los Angeles suburb of San Marino. A desire to be a veterinarian led him to UC Davis to major in animal science. The introduction to animal science class his freshman year opened his eyes to the opportunities in livestock production. He earned both his bachelor's (2007) and master's (2011) degrees from UC Davis and then his PhD in animal science with a specialization in meat science and muscle biology from University of Nebraska-Lincoln in 2015.

"We are delighted that Dr. Chao is joining the Department of Animal Sciences and Industry," says Dr. Evan Titgemeyer, K-State ASI interim department head. "His training and experience will be an important addition to our team serving the meat industry. He's a great fit for our department because he has a passion for teaching, yet he also has research skills that complement our existing faculty extremely well."

At K-State, Michael's appointment will be 60% research and 40% teaching. In his role, he will teach advanced meat science and is in process of developing a fresh meat-based class.

He has worked for the US Meat Export Federation, both as an intern based in the organization's Denver headquarters and Taiwan office, and later a contract basis to lead Taiwanese and Chinese auditing and business teams through beef and lamb processing plants in the United States.

An avid outdoorsman, Michael says, "I look forward to the vast fishing and hunting opportunities in Kansas."

Michael and his wife, Ying, have two sons — Luke and Hans.



**Randy Phebus ([phebus@k-state.edu](mailto:phebus@k-state.edu); 785-532-1215)**  
**Professor, Food Microbiology and Safety**

Dr. Randy Phebus is from Waverly, Tennessee, a small town seventy miles west of Nashville. He attended the University of Tennessee in Knoxville from 1981-1992, earning B.S. (Animal Science), M.S. and Ph.D. degrees (Food Science). Dr. Phebus joined the K-State ASI department in 1992 and has a 30% teaching and 70% research appointment within the Food Science discipline group. He teaches both undergraduate and graduate level courses in Food Science and is active in the distance learning Global Campus Food Science program and student recruitment. He specializes in food microbiology, food safety, food biosecurity and defense, and public health.

Dr. Phebus coordinates an active applied food safety research program spanning most food categories. He is a member of the K-State Food Science Institute, and holds graduate faculty status in Food Science, Animal Sciences, and Pathobiology. He works closely with food processors, regulators, and technology providers across the country to improve food quality and safety through laboratory-based and processing-based research and troubleshooting activities. Recently, the U.S. Secretary of Agriculture appointed him to the National Advisory Committee on Meat and Poultry Inspection. He is a research fellow at the K-State Biosecurity Research Institute, where his team conducts large-scale pathogen-inoculated studies under biocontainment to support food industry food safety needs.

Personally, Dr. Phebus cheers on his Tennessee Volunteers and K-State Wildcats. All of Dr. Phebus' spare time is spent on home improvement and gardening projects that never seem to be completed, and on riding his motorcycle around the beautiful Kansas Flint Hills.

# KSU Cow-Calf Checklist – November 2022

## Management Considerations for January 2023

By Jason M. Warner, Ph.D., Extension Cow-Calf Specialist

### **Cow herd management**

- Body condition score both spring- and fall-calving cows.
  - Target BCS for spring calvers: 5 for mature cows, 6 for young females
  - Adjust nutrition program prior to calving as needed for spring-calvers
  - Ensure fall-calvers maintain BCS through winter if still nursing calves
- Continue grazing crop residues and dormant pastures as they are available but be prepared to move cattle or provide supplemental feed as conditions dictate.
- Be ready to react to severe winter weather effects on cow nutrient requirements by providing additional feed which may be more challenging this year with a tighter supply of forages.
- Review your nutrition program and test harvested forages for the following:
  - Moisture/dry matter
  - Crude protein
  - Energy (NE<sub>m</sub>, NE<sub>g</sub>, and/or TDN)
  - Fiber components (ADF, NDF)
  - Macro-minerals (calcium, phosphorus, magnesium, potassium, salt)
  - Nitrates when appropriate
  - Starch for silage crops
- Manage young and mature bulls during the offseason to ensure bulls are BCS ≥ 5.0 prior to the next season of use and have adequate winter protection.

### **Calf management**

- Consider your plans for weaning and marketing fall-born calves.
  - Watch the feeder calf market
  - Evaluate your feed resources and cost of gain
  - Talk to prospective buyers in advance of selling
- Review/update your health protocols as needed for new-born calves.
- Consider either supplementing fall-calving pairs or creep feeding fall-born calves to maintain calf performance on low-quality winter forages.
- Monitor replacement heifers to ensure they are adequately growing and developing, take check weights and adjust your plane of nutrition accordingly

### **General Management**

- Update herd records and use them to assess performance.
- Review your genetic selection strategy to ensure your goals are met.
- Develop and/or revise your risk management plans for the coming year.
- Discuss herd health protocol with your veterinarian.
- Take inventory of supplies and clean equipment prior to spring calving.
- Ensure plans are in place to provide bedding, wind protection, and snow removal.
- Make arrangements to ensure sufficient water is available in freezing conditions.
- Evaluate your short and long-term herd inventory goals with current conditions.
- Renew lease arrangements, as necessary.
- Schedule an annual meeting with your lender, insurance agent, and extension professional.

*We need your input! If you have any suggestions or comments on **News from KSU Animal Sciences**, please let us know by e-mail to [lschrein@ksu.edu](mailto:lschrein@ksu.edu)*