Below you'll find short summaries highlighting publications impacting ruminant and other species nutrition in the US. Please feel free to reach out with any questions or if seeking specific follow-up information.

Effects of increasing dietary levels of a palmitic acid-enriched supplement on fiber digestibility, rumen fermentation, and microbial composition in high-fiber diets (Wenner et al., 2025): The past 10 years have brought about a lot of changes in our approach to fat supplementation in lactating dairy diets. First, palmitic acid was pushed in to drive up butterfat but then the balance of oleic and palmitic acids became a clear factor in maintaining body condition and yet increasing milkfat content; the optimal balance of these two varies based on cow stage of lactation. One underlying factor that was largely ignored is the effect that these fat feeding strategies have on the microbial population in the rumen: nutrient digestibility, membrane composition, and even protein yield to the cow. This study demonstrates a clear improvement in NDF digestibility with high palmitic supplementation, driven by exchange of Lachnospiraceae for Prevotellaceae bacteria. Taken in combination with Sears et al. (2024; previously featured in this newsletter), we know that oleic acid at high doses can suppress fiber digestibility whereas NDF digestibility is clearly improved by the palmitic acid portion of the supplement. Batistel et al. (2025) indicates that blended palmitic and oleic acid can also improve nutrient digestibility when the oleic acid dose isn't so extreme. These improvements in fiber digestibility likely stem from changes in the microbial membrane composition that improve ability to enzymatically degrade fiber particles and other feeds. The changes in nutrient digestibility observed translate into better butterfat from the cow not only from the dietary fat absorbed but also from improved total diet digestibility and improvements in VFA, specifically butyrate and acetate.

Antioxidant Power of Brown Algae: *Ascophyllum nodosum* and *Fucus vesiculosus* Extracts Mitigate Oxidative Stress In Vitro and In Vivo (Karlsberger et al., 2025): This study examined the antioxidant activity of two brown algae, **Ascophyllum nodosum (AN)** and **Fucus vesiculosus (FV)**, and their ability to mitigate oxidative stress in vitro and in vivo. Total phenolic content and antioxidant capacity was about 3-fold greater for FV than AN,

For more information, reach out to this issue's contributors:

Becca Culbertson: becca.culbertson@feedworksusa.com
Dr. Benjamin Wenner: benjamin.wenner@feedworksusa.com

and FV had a broader profile of phlorotannins while AN had 10 phlorotannins, but had a higher total polysaccharide content, indicating greater amounts of fucoidans, laminarins, and alginates. Phlorotannins are potent polyphenolic antioxidants, while fucoidans and laminarins are bioactive polysaccharides known for antioxidant, anti-inflammatory, and immunomodulatory properties. In vitro tests using human and porcine intestinal epithelial cells showed that both AN and FV extracts reduced reactive oxygen species (ROS) production under chemically induced oxidative stress in a dose-dependent manner. The FV showed stronger ROS-scavenging activity, which correlated with its higher phenolic and phlorotannin content. In vivo experiments with the nematode *C. elegans* revealed that paraquat-induced oxidative stress reduced worm motility. Pre-treatment with AN preserved motility by 22% compared to stressed controls, while FV improved motility by 11-12% at higher doses. These results suggest that AN may be more effective under acute oxidative stress, while FV may be less bioavailable in vivo.

The impact of excess liver copper concentrations on response to a bovine respiratory disease challenge in lightweight beef-on-dairy crossbred steers (Henderson et al., 2025): This study investigated how elevated liver copper (Cu) concentrations impact disease response in lightweight beef-on-dairy crossbred steers. These calves accumulate excess Cu early due to maternal transfer during gestation and the use of Cu-fortified feeds in dairy systems. Steers (n=26; ~8 weeks old) were fed either an adequate or high (HIGH) Cu diet for 120 days to induce different liver Cu levels (279 vs. 608 mg Cu/kg liver DM). Afterward, all steers underwent a controlled BRD challenge. The HIGH group showed greater clinical signs of disease beginning on day 4 and persisting through the trial. HIGH steers had lower serum albumin and glucose levels, suggesting possible liver dysfunction and heightened metabolic demands. While both groups showed strong inflammatory responses, antioxidant capacity had a sharper decline in the HIGH group, and these steers exhibited greater expression of the oxidative stress gene *NRF2* in respiratory tract cells. No differences in gut permeability were observed between treatments, indicating that the increased disease severity in HIGH steers was not due to differences in bacterial burden or gut barrier function. They concluded that excessive liver Cu impairs the immune response and

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Becca Culbertson: becca.culbertson@feedworksusa.com
Dr. Benjamin Wenner: benjamin.wenner@feedworksusa.com

worsens disease severity in beef-on-dairy calves, highlighting the importance of careful trace mineral management in calves.

Salmate DHA+ fish oil supplement fed to boars and impact on sperm production (Parrish et al., 2025): In this recent publication, Parrish, along with several on the Feedworks team, demonstrated the effects of Salmate DHA+ on sperm production in boars. Duroc boars (n=10) were fed a control diet for 62 days, after which half were switched to the control diet plus 26 g/day of Salmate DHA+ (providing 1.82 g DHA and 0.78 g EPA) for an additional 62 days. Boars receiving Salmate experienced a 1.18-fold increase in total sperm per ejaculate, from 103×10^9 to 123×10^9, which is roughly 6 additional insemination doses per collection. Progressive motility also improved with supplementation, while overall semen quality remained within acceptable thresholds. Histological analysis of testis tissue showed a 1.59-fold increase in the ratio of round spermatids to Sertoli cells in Salmate-fed boars, reflecting decreased germ cell apoptosis. This was the first demonstration that a refined fish oil supplement can increase sperm production in boars by directly reducing apoptosis within the testes, highlighting the potential of Salmate DHA+ as a nutritional strategy to improve reproductive performance in boars.

European Association for Animal Production Annual Meeting Recap:

- Demehin et al. presented that Calmin reduced calcium-phytate interactions and improved nutrient utilization in weaner pigs. Phytate, the primary storage form of phosphorus in plants, binds to calcium and reduces the effectiveness of phytase, limiting phosphorus release. In a 32-piglet trial, diets with Calmin supported higher phosphorus digestibility, improved feed conversion ratio, and improved daily gain compared to traditional limestone-based calcium sources, even when monocalcium phosphate was reduced or removed. The unique structure of Calmin, with its calcified outer layer, hydrogel matrix, and mineral-rich core, enhances calcium solubility and reduces precipitation with phytate, making more phosphorus available.

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Becca Culbertson: becca.culbertson@feedworksusa.com
Dr. Benjamin Wenner: benjamin.wenner@feedworksusa.com

- Naughton et al. from Celtic Sea Minerals highlighted the large variability in solubility among Mg supplements and how testing method influences results. Magnesium source (n=62) sampled globally (including 19 from the U.S.) were evaluated through compositional analysis, HCl titration, acetic acid titration, and a novel in vitro fermentation approach. Particle size ranged widely (26-345 µm), and solubility also varied, with HCl titration showing some sources required nearly 40x more acid to dissolve than others. Acetic acid and in vitro tests reported lower solubilities, with the in vitro model considered most physiologically relevant, especially at 6 hours. Results reinforced that Mg bioavailability varies and depends heavily on source characteristics and testing approach.
- Though supplementation of dairy cows with 3-NOP effectively reduces enteric methane, there are concerns around welfare, productivity, and dairy product quality. Franchi et al. reported that cows receiving 3-NOP showed reduced DMI and milk yield, which may indicate discomfort potentially linked to ruminal hydrogen accumulation or toxic blood metabolites. At the same time, while 3-NOP had little effect on milk composition or coagulation properties, it reduced lactose content and was associated with negative sensory outcomes in cheese and butter, including bitterness, off-aromas, and poor consumer acceptance (Foggi et al.). Anecdotally, the cheese from 3-NOP-fed cows was described by presenters as unpleasant enough that panelists refused to take a second bite.
- Concerns over the safety of synthetic antioxidants have intensified research into natural alternatives. Mavrommatis spoke on how commonly used compounds such as butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT) are effective, but studies have linked their excessive or prolonged use to DNA damage, oxidative stress, and carcinogenic effects in animals. Similarly, evidence from large-scale trials and meta-analyses has shown inconsistent and sometimes adverse outcomes for synthetic vitamin E supplementation, including increased prostate cancer risk in certain populations. These factors highlight a clear need for the use of natural antioxidant sources, such as natural plant extracts and polyphenols, which may offer safer and multifunctional benefits in both animal health and food systems.

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Becca Culbertson: becca.culbertson@feedworksusa.com
Dr. Benjamin Wenner: benjamin.wenner@feedworksusa.com

- An in-vitro study by Dhakal et al. simulated rumen temperatures from 103°F to 110°F and found that elevated temperatures did not affect pH, gas, or methane production, but significantly reduced VFA. At 110°F, acetic, propionic, butyric acids, and total VFAs were all markedly lower, implying that heat stress can significantly impair rumen fermentation efficiency and energy supply to the cow.
- A recent study co-authored by Feedworks USA's own, Mike Parsley and Tom Gall, compared traditional supplemental copper sources to CoRouge (a potentiated copper oxide) for their ability to control *Streptococcus suis* and improve piglet performance after weaning. In vitro, CoRouge showed the strongest inhibitory effect against *S. suis*, stopping growth at just 64 µ*M* compared with 256 µ*M* required for conventional copper sources. In vivo, supplementation with CoRouge at 75 and 100 ppm improved feed intake and ADG compared with the negative control, performing as well as tribasic copper chloride at 150 ppm, while using less supplemental copper and reducing environmental excretion.
- The role of the microbiota-gut-brain axis in regulating host physiology, behavior, and stress resilience was a popular topic. Gerard Clarke's talk presented that gut microbes act as "metabolic factories," producing key metabolites that shape barrier integrity, neuroendocrine signaling, and emotional states, while stress was shown to disrupt these pathways and contribute to disorders such as anxiety, depression, and irritable bowel syndrome. Extending these concepts to livestock, a PhD candidate from Aarhus University demonstrated how prolonged stress during weaning in piglets exacerbated post-weaning diarrhea and shifted microbial and metabolic profiles. An ETEC challenge further reduced microbial diversity, impaired neurotransmitter and SCFA production, and increased pathogen shedding. Animal stress clearly alters both microbial composition and function, which in turn feeds back on host health and performance. Targeting this multifaceted signaling axis through nutritional interventions is one of the most promising strategies to mitigate stress-related disorders, improve gut barrier function, and enhance resilience in our herds.

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Becca Culbertson: becca.culbertson@feedworksusa.com
Dr. Benjamin Wenner: benjamin.wenner@feedworksusa.com

From the archives:

Effects of various mastitis treatments on the reproductive performance of cows (Smulski et al., 2020): In this study, researchers evaluated how different supportive therapies influenced mastitis recovery and reproductive performance in dairy cows. The supportive treatments included antioxidants, an immunomodulator (lysozyme dimer), and an NSAID. All cows diagnosed with clinical mastitis received standard intramammary antibiotics, while experimental groups also received one of the supportive treatments as a single injection. The most notable results were seen in the group that received antioxidants (vitamin C, vitamin E, and β-carotene) in addition to antibiotics. This group achieved the highest cure rate of all groups, with 2/3 of affected quarters recovering after treatment. Reproductive performance also improved in the antioxidant group; these cows had the shortest time to first insemination and fewer days open compared to cows treated with antibiotics alone. The authors suggest that these improvements are due to the role antioxidants play in counteracting oxidative stress during inflammation. Clinical mastitis triggers the production of ROS, which can damage ovarian tissues, suppress progesterone production, and promote apoptosis in luteal cells. Antioxidants neutralize ROS to protect reproductive and immune function. Cows treated with antioxidants also showed the greatest increase in total antioxidant status from day 0 to 7, supporting the idea that supplementation helped rebalance oxidative stress during mastitis recovery.

Other notes:

1. In case you missed it, Feedworks USA's own, Dr. Tommy Shipp, gave an informative webinar featured in D&D Ingredients' August Spotlight Program. He outlined how oxidative stress takes a toll on the performance, immunity, and overall health of all species. He illustrates how Elife, a powerful antioxidant derived from a carefully selected blend of polyphenols, can help maintain oxidative balance and support livestock during periods of increased nutritional demand.
2. Silage season is upon us and now is a good time to read (or re-read) this primer from Dr. Bill Mahana with Pioneer. This provides a nice read on

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Becca Culbertson: becca.culbertson@feedworksusa.com
Dr. Benjamin Wenner: benjamin.wenner@feedworksusa.com

key factors in both good and bad silage piles, especially on the proliferation of unwanted yeasts.

3. Dairyland Lab presented at the International Silage Conference and shared out a summary of the presentation in their newsletter. The discussion of what drives largest variations in NIR forage results (perception of regional lab bias versus subsampling error, for example) is an interesting short read.
4. Dr. Jose Santos was recently featured in the Commodity Blenders newsletter's "Research Notes", issue 41. In this dialogue, he emphasizes both the importance of keeping cows over 0.6% Ca (0.6-0.8% of DMI) and supplementing high availability Mg in transition cows. Our own products, Calmin or Calmin 12, are perfect fits as they bring high Ca and Mg without the P load, enabling both acidogenic and zeolite transition approaches to hit their nutrient targets without additional P.
5. Using 16S rRNA gene sequencing, Young et al. (2025) profiled bacterial communities from the rumen, small intestine, large intestine, and feces in 436 steers categorized by liver health at harvest. Cattle with severe (A+) LA showed greater microbial richness and evenness in the small intestine compared to cattle with healthy livers, as well as a lower Firmicutes-to-Bacteroidota ratio. The bacterial families Prevotellaceae and Synergistaceae were more abundant in the small intestine of cattle with LAs. However, no meaningful differences were found in fecal, ruminal, or colonic microbial diversity or structure associated with liver abscess status. Bacteria traditionally associated with LAs (like Fusobacterium necrophorum, Trueperella pyogenes) were not differentially abundant in any gut region. The researchers suggest that the small intestine's microbial community may play a more active or indicative role in LA development than previously thought.
6. Paired-housing of replacement calves is a contentious topic among producers and consultants alike. However, Moroz et al. (2025) recently completed a study looking at pairing calves at different ages pre-weaning and found that many of the negative connotations with paired housing (e.g., non-nutritive cross-sucking) are reduced when calves are paired earlier in life (first week) whereas more positive behaviors (e.g., exploration and on-feed time) were improved in that earlier pairing timeframe. There was no difference in this study on health effects based

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Becca Culbertson: becca.culbertson@feedworksusa.com
Dr. Benjamin Wenner: benjamin.wenner@feedworksusa.com

on pairing age; however, more data will need to be generated on disease risks in earlier paired calves to convince many producers to make this change.

7. Tenório de Oliveira et al. (2025) investigated the effects of chitosan (CHI) and technical cashew nut shell liquid (CNSLt), both individually and in combination, as alternatives to the ionophore monensin in high-grain diets for feedlot steers. They tested five treatments: control (no additive), monensin, CHI alone, CNSLt alone, and CHI + CNSLt. The combination of CHI + CNSLt improved starch digestibility at the expense of fiber digestibility, and reduced the excretion of intact corn kernels in feces, indicating better starch utilization. CHI + CNSLt altered ruminal fermentation by increasing the proportion of propionate and reducing acetate, butyrate, and estimated methane production, which suggests a shift toward a more energy-efficient fermentation profile and demonstrates CHI antibacterial activity. Steers on the CHI + CNSLt diet had lower DMI and fiber intake, likely due to metabolic feedback associated with increased propionate (hepatic oxidation theory).
8. Zachweija et al. (2025) evaluated the impact of short-term supplementation of beef cattle with rumen-protected cod liver oil (CLO) in both Limousin and Red Angus. 60 finishing bulls (30/breed) were fed under identical conditions, with half of each breed group receiving 100 g/d of microencapsulated CLO (high omega-3 content) during the final 3 weeks pre-slaughter. They found that supplementation reduced intramuscular fat content and altered FA composition in ways considered to be beneficial for human health. In Limousin meat, supplementation decreased levels of saturated FAs and increased levels of cis-oleic acid and total MUFAs. Limousin beef also had a better PUFA/SFA ratio and higher n-3 FA content, whereas Red Angus beef had higher MUFAs but also a greater thrombogenic index (TI) and atherogenic index (AI), suggesting more saturated and potentially less heart-healthy fat. Supplementation with rumen-protected CLO may enhance the FA profile of beef and lend towards a product perceived to be healthier for consumers.
9. Bulnes et al. (2025) reported on a research project looking at cows fed a novel probiotic (Galaxis Frontier) and effects on productivity and health markers post-parturition. The probiotic did increase milk yield, especially

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Becca Culbertson: becca.culbertson@feedworksusa.com
Dr. Benjamin Wenner: benjamin.wenner@feedworksusa.com

post-peak (+7 lbs). However, component yields were not affected and samples indicate few changes in key bacteria sampled.

10. One challenge with quantifying the effects of protozoa on the rumen population is that it's extremely difficult to isolate protozoa from their bacterial symbionts. Kim et al. (2025) attempted to more thoroughly wash and filter protozoa from bacteria not directly associated with protozoal membranes. They found several key fibrolytic bacteria (*Butyrivibrio fibrosolvens* and *Fibrobacter succinogenes*) were heavily enriched in the washed *Isotrichid* spp. protozoal sample. Several other genera (within Lachnospiraceae, Oscillospiraceae, Rikenellaceae) were also enriched in the protozoal samples, indicating they may have key symbiotic roles with protozoa.
11. In another recently published protozoal paper, Kobel et al. (2025) characterized two distinct populations (RCT-A and RCT-B) of rumen protozoa within 80 feedlot cattle. These distinct population types are not a new concept but the depth to which these distinct types permeated results (genetic transcription, bacterial populations, **liver** metabolic expression) is pretty astounding. This paper gives clear evidence that the protozoa living within the rumen are clearly tied to the health and productivity of their host and induce effects well beyond the rumen wall.
12. To evaluate how early-life heat stress affects dairy calf physiology and performance, Neves et al. (2025) housed calves in a chamber from 0-28 days and assigned them to a thermoneutral group (CON; 71.5°F, THI 66) or a heat-stressed group (HS; 90°F, THI 82) for 9 hours/d. Despite similar growth rates and feed efficiency, HS calves exhibited the expected higher respiratory rates, rectal temperatures, and an increase in water intake. Interestingly, HS calves' immune response also shifted toward a more anti-inflammatory profile, suggesting an adaptive mechanism to limit heat-induced cell damage and conserve energy. However, this adaptation can impair immune responsiveness. This work demonstrates that **neonatal heat stress can trigger changes in internal function even when external performance indicators remain stable**. The first month of life is a critical window for immune and metabolic development, and without intervention, heat stress may silently compromise long-term health and production.

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Becca Culbertson: becca.culbertson@feedworksusa.com
Dr. Benjamin Wenner: benjamin.wenner@feedworksusa.com