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In This Issue

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From the Editor – An article published in June of 2021 in Veterinary Record discussed the impact of disseminating research findings related to contagious ovine digital dermatitis (CODD) on the knowledge and practices of sheep farmers and veterinarians in the UK. In response to a question regarding improvement in the management of CODD following the recent guidance, 52% of farmers agreed that their management had been improved. Overall, 70% of veterinarians stated that their advice on the management of CODD had improved, with 45% of vets decreasing their use of whole flock antibiotic treatments and 63% changing their advice on biosecurity measures.

The take-home message was that applied research can guide evidence-based decisions by both farmers and vets particularly in the areas of antibiotic use and biosecurity. On that note, one of the articles below covers evidence-based veterinary medicine based on presentations given at the American Association of Bovine Practitioners' annual meeting. And if you are interested in learning more about biosecurity for small-scale livestock producers, please check out our currently underway webinar series entitled "Farm Animal Risk Mitigation: Prepare Prevent Evaluate." It is not too late to register!

A key component of the project mentioned above was the dissemination of research findings to veterinarians and sheep farmers via knowledge exchange activities (continuing education) including presentations at national and international veterinary conferences, farmer CE meetings, on-farm demonstrations, articles in the veterinary and farming press, creation of industry manuals and contributions to policy and webinars. The underlying research covered a broad spectrum from pathophysiology to therapy, and the information outreach utilized multiple platforms of engagement. These findings highlight the impact that we can have through our research and extension endeavors here at WSU as we aim to shed light on animal health and production issues through collaborations with various stakeholders. It is with this in mind that I have started off this newsletter with updates from our ongoing research investigations. For some of you this will be a review, but for those with whom we have not had a chance to connect I hope this provides some useful food for thought that might just help guide evidence-based management decisions. If nothing else, it provides me an avenue to brag a bit about our exceptional veterinary and graduate student clinical research scientists!

FDIU Research Updates: Dairy

By CS McConnel, Veterinary Medicine Extension

As many of you know, we have been attempting to apply the concept of a disability-adjusted life year (DALY) summary measure of health to dairy population medicine. The DALY was developed in the 1990s for use in human medical epidemiology to measure overall disease burden, expressed as the number of years lost due to ill-health, disability, or early death. It is a metric used by the World Health Organization to assess the global burden of disease. Our goal is to measure the lifetime burden of dairy cow diseases and disease sequelae by aligning standard measures of productivity with physiological impacts described through clinical assessments and molecular diagnostics.

This line of research has allowed us to investigate various diagnostic modalities while keeping an eye on practical management impacts. Over this past summer that translated into four summer research projects conducted on two WA dairies by veterinary students attempting to improve our understanding of preweaned dairy calf disease processes and impacts. First, Chris Mandella focused on the utility of white blood cell (WBC) counts and plasma fibrinogen levels for diagnosing gastrointestinal (GI) and respiratory disease in dairy calves. His project aimed to establish reference intervals and investigate relationships between fibrinogen and WBCs in healthy and diseased dairy calves. Our hope was that fibrinogen might prove to be a useful indicator of both acute and chronic inflammatory disease processes in these calves, providing an on-farm option for assessing disease progression and severity. Unfortunately, fibrinogen alone ultimately proved to be a poor diagnostic indicator for clinical respiratory or GI disease. However, age-dependent total and differential WBC counts used in conjunction with fibrinogen levels did provide a useful diagnostic indicator of respiratory disease. Importantly, Chris was able to establish reference intervals for WBC counts and fibrinogen at three critical age ranges based on age at sampling (1-2 weeks, 3-5 weeks, 7-11 weeks). These intervals were based on calves with no evidence of clinical or subclinical disease and provide us with a more nuanced assessment of WBC and fibrinogen levels in healthy preweaned calves as compared to standard bovine clinical pathology panels (**Table 1**).

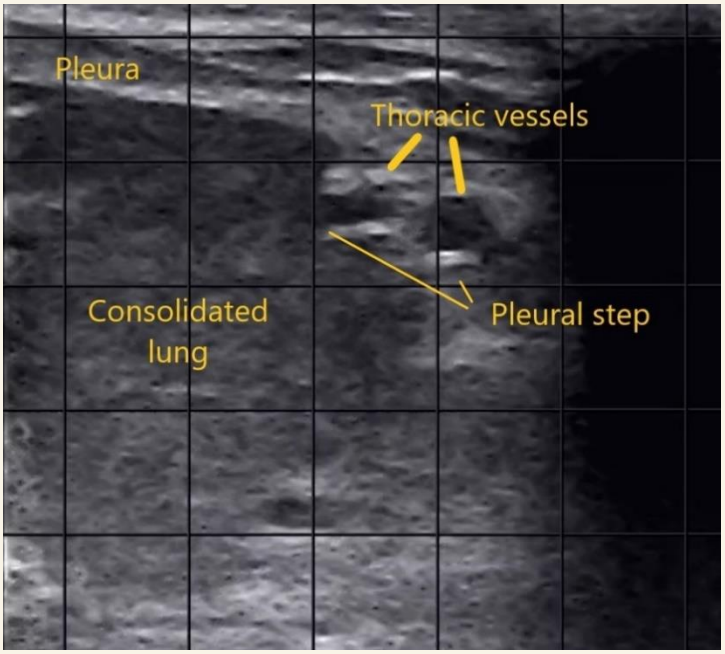
Table 1: WBC, PCV, total protein and fibrinogen reference intervals for healthy Holstein dairy calves per weeks of age as compared to standard bovine reference intervals.

	WSU Clin Path	FDIU Preweaned Dairy Calves		
Parameter	**Bovine panel**	**Week 1**	**Weeks 3-5**	**Weeks 7-11**
WBC (10^3/µL)	5.5 - 13.5	2.7 - 9.7	5.5 - 13.9	5.5 - 14.7
Neutrophils (10^3/µL)	1.4 - 8.0	1.0 - 6.2	0.8 - 7.0	0.8 - 5.7
Lymphocytes (10^3/µL)	2.3 - 6.6	1.3 - 5.6	3.1 - 8.2	3.4 - 9.1
Monocytes (10^3/µL)	0 - 1.4	0 - 0.5	0 - 0.6	0 - 1.0
Eosinophils (10^3/µL)	0 - 0.8	0 - 0.2	0 - 0.3	0 - 0.5
Basophils (10^3/µL)	0 - 0.3	0 - 0.3	0 - 0.2	0 - 0.2
PCV (%)	25 - 33	16 - 45	23 - 47	24 - 43
Total Protein (g/dL)	5.8 - 8.3	5.2 - 6.7	5.0 - 6.4	5.5 - 6.5
Fibrinogen (mg/dL)	200 - 600	200 - 800	300 - 700	200 - 600

For our second project, Holly Hinnant investigated the alignment of clinical signs of bovine respiratory disease (BRD) with thoracic ultrasound findings. She utilized a standard clinical scoring matrix and calf lung ultrasound scoring chart developed through the University of Wisconsin. Calves were assessed weekly through 11-weeks of life, and Holly found that 45% (27/60) of the calves in the study demonstrated clinical signs of BRD and/or lobar lung consolidation (**Figure 1**) during at least one weekly examination. Diagnoses of BRD peaked at 6 weeks of age for both clinical exams and thoracic ultrasonography. However, agreement between lung consolidation

seen on thoracic ultrasound and clinical respiratory signs was limited and aligned best only at the onset of lobar consolidation. Clinical signs one week before or after ultrasonographic evidence of lobar consolidation showed lesser agreement. In other words, clinical assessments did not prove particularly useful in predicting either the development or chronic duration of severe lung pathology. Importantly, these findings predicted that on-farm personnel would find it challenging to identify and treat calves with BRD prior to severe pathology developing. This proved true in that although 28% (17/60) of calves were treated with antimicrobials administered by farm personnel based on their observations of clinical signs, 41% (7/17) of those calves were treated after the initial onset of consolidation. Nevertheless, 55% (15/27) of calves with lobar consolidation diagnosed by thoracic ultrasound actually recovered by the end of the study even though only four of those calves were treated with antimicrobials! Although this certainly was not the first study indicating a lack of clinical sign sensitivity and specificity for diagnosing BRD, the sequential nature of this study did provide novel insight into the sometimes-transient nature of lung consolidation with or without therapeutic interventions. Currently, thoracic ultrasonography is most often used to direct culling decisions within grouped weaned pens; however, it may be that this tool can be incorporated into standard management protocols to help guide preweaned interventions supporting antimicrobial stewardship and animal well-being. *If you are interested in learning more about calf thoracic ultrasonography please let me know (cmcconnel@wsu.edu; 509-335-0766), as we were able to assemble a number of tips and tricks based on the frequent and repeated nature of this project*.

Figure 1: Full thickness lobar consolidation of the right cranial aspect of the cranial lung lobe.

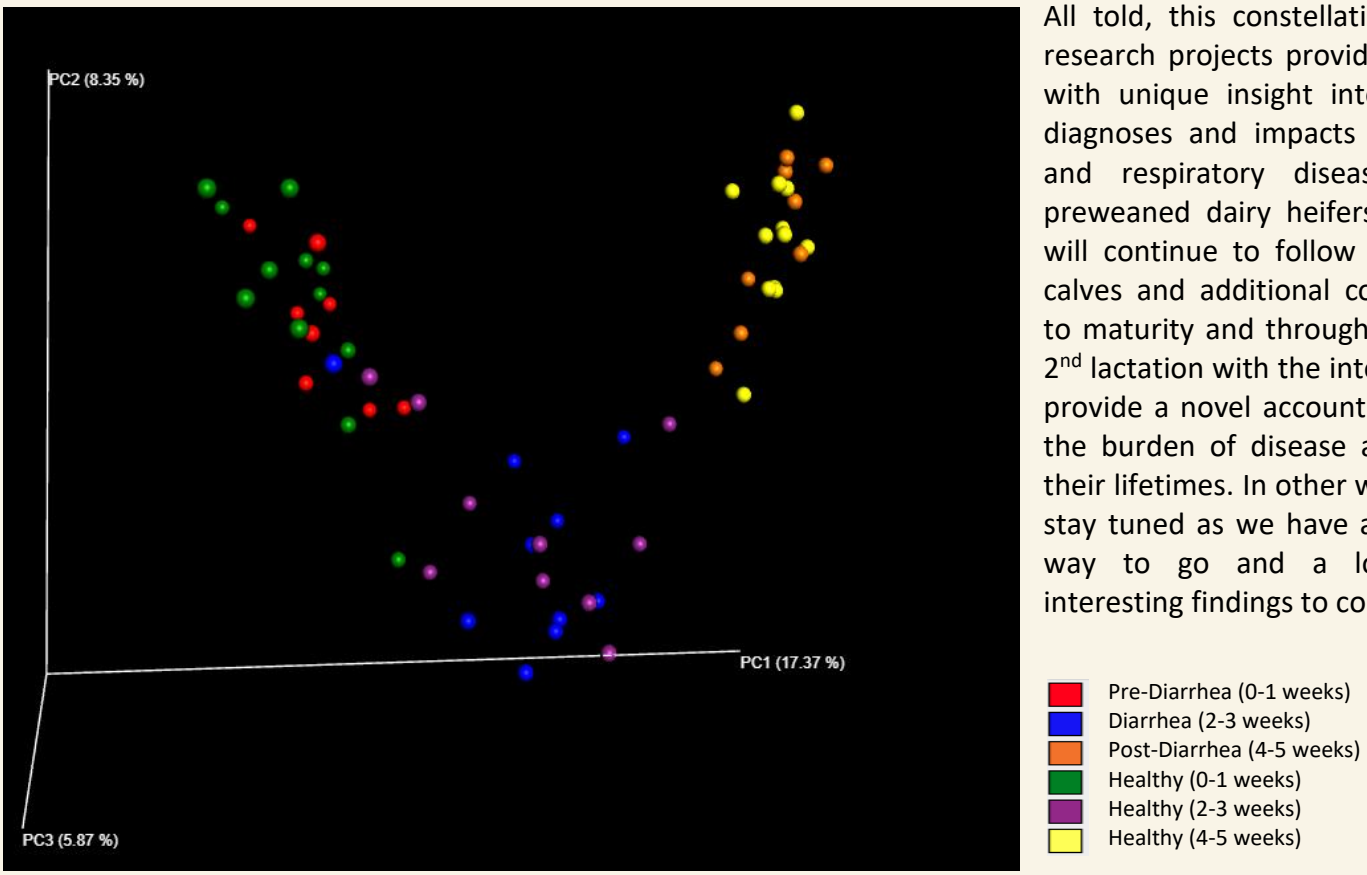


Interactions and variabilities between pathogen exposure, environmental and immunological factors, and therapeutic choices make BRD a complex disease to manage. It is this complexity that provided the foundation for our third project of the summer carried out by Lily Elder. Lily questioned whether differential gene expression in peripheral leukocytes could be used to evaluate innate immune responses to BRD relative to age in preweaned dairy calves. She chose 19 genes involved in inflammatory, regulatory, antibacterial, or antiviral innate immune pathways, and that previously had been shown to be differentially expressed in cattle with BRD and other infectious diseases. Contrary to expectations, no differential gene expression was observed between calves when comparing diseased versus healthy animals of the same age. However, differential expression was observed for certain genes between ages of calves (B-Y $p < 0.05$) when comparing all calves, healthy calves, and calves grouped by disease state. Furthermore, the magnitude of these age-dependent differences for given genes was dependent upon disease state. Overall, her findings indicated that age and immune development overlap with disease impacts to drive gene expression patterns in young calves, and the trajectory of immune development is potentially altered during disease.

This theme of age-related outcomes carried on into our fourth project of the summer, conducted by Rachel Claus-Walker. Rachel built on our previous investigations into the impacts of calf GI disease on the fecal microbiome. Her objective was to describe the fecal microbiome in dairy calves before, during, and after GI disease as evidenced by diarrhea. Holstein dairy calves aged 1-11 days were enrolled on the two dairies and followed through 5-weeks of age. Clinical oversight was provided daily by on-farm personnel and formal clinical assessments were performed using the standardized Wisconsin calf health-scoring chart and additional

behavioral evaluations. Fecal samples were collected every other week and diarrhea was based on a fecal score of ≥2 (range 0-3). The fecal microbiome from calves that developed GI disease between 2-3 weeks of age (n=19) was compared to calves that remained healthy throughout the duration of the study (n=26). A beta-diversity plot demonstrated that differences in the fecal microbial composition of calves were strongly associated with age rather than health status (**Figure 2**). However, the relative abundance of organisms of the genus *Escherichia* was enriched in calves the week prior to diarrhea as compared to healthy calves of the same age range. Moreover, loss of diversity was not observed in calves that recovered from uncomplicated GI disease episodes. These findings were somewhat surprising given that a previous FDIU investigation suggested that even uncomplicated GI disease can lead to differences in beta-diversity between healthy and diseased calves. However, that previous study was based on a population of calves receiving metaphylactic treatment in the form of medicated milk replacer (neomycin and oxytetracycline) between 5-12 days of age to combat ongoing GI disease problems. Although we have additional analyses to pursue regarding these studies, the implication is that the GI microbiome of calves experiencing uncomplicated GI disease (i.e., calf scours) is resilient and able to resume a healthy baseline with appropriate nutrition and supportive care alone. This aligns with a body of research suggesting that antimicrobial therapy for uncomplicated calf scours is unnecessary and typically ill-advised.

Figure 2: Beta-diversity plot comparing preweaned dairy calves' fecal microbiome based on age and health status.



All told, this constellation of research projects provided us with unique insight into the diagnoses and impacts of GI and respiratory disease in preweaned dairy heifers. We will continue to follow these calves and additional cohorts to maturity and through their 2nd lactation with the intent to provide a novel accounting of the burden of disease across their lifetimes. In other words, stay tuned as we have a long way to go and a lot of interesting findings to come!

FDIU Research Update: Pasture Impacts on CH_4

By Giovana Slanzon, PhD Candidate, Clinical and Translational Sciences, WSU

Methane (CH_4) is a by-product of the microbial fermentation process from a group of Archaea known collectively as methanogens. Ruminant livestock harbor these methanogens as a component of their normal gastrointestinal microflora. Because ruminants do not utilize CH_4, the gas produced during digestion is emitted into the atmosphere. Furthermore, changes to the diet can alter the ruminal and fecal microbial community structure and contribute to differences in CH_4 gas production. In fact, CH_4 emissions are often associated with the use of pasture as a primary feed source. Therefore, we have been evaluating the effect of temporal changes in diet composition on the abundance and diversity of fecal methanogens within pasture-based organic dairy cows.

Per organic requirements, a 70:30 ratio of total mixed ration (TMR) and pasture was allocated during the May through September grazing season. Of course, variabilities in pasture quality, availability, and animal preference dictated that individual animal levels of TMR and pasture consumption undoubtedly fluctuated a great deal. Nonetheless, pasture, TMR, and fecal samples were collected at 7 different time points over the course of a year. Pasture qualities (starch, dry matter, crude protein, fat, and fiber) did not seem to be associated with changes in the fecal microbiome in our dataset. However, samples tended to cluster based on whether the diet was primarily pasture-based or exclusively a TMR. We did not observe major changes in the relative abundance of methanogens across clusters; however, clusters associated with a pasture diet had a lower relative abundance of organisms of the genus *Bifidobacterium* and *Succinivibrio*. Similar patterns have been reported previously by Hagey et al. (Front Microbiol. 2019) when comparing samples from dairy cows housed on pasture, drylots, or freestalls. Moreover, samples associated with an exclusively TMR diet had lower diversity (richness and evenness) as compared with samples associated with a pasture-based diet. In addition, we investigated the relationship between methanogens and bacteria. A co-occurrence network indicated that samples associated with a pasture diet had greater and stronger interactions between bacteria and methanogens when compared with samples associated with a TMR diet. This suggests that the fecal microbial composition and relationships between organisms are affected by the type of diet (pasture vs. TMR).

Mitigation strategies to decrease CH_4 emissions include increasing the concentrate to forage ratio, decreasing pasture maturity, and adopting grazing systems targeting high quality pasture. However, altering the concentrate to forage ratio might prove difficult for many pasture-based enterprises. Therefore, improving our understanding of how pasture and TMR qualities affect the microbial community and associated CH_4 emissions may eventually help reduce enteric CH_4 emissions through diet manipulation.

Small Ruminants: Herd Health, Medicine & Surgery

By CS McConnel, Veterinary Medicine Extension

Dr. Amanda Kreuder from Iowa State University's College of Veterinary Medicine provided an informative yet succinct take on small ruminant practice for the bovine practitioner at the AABP annual convention this past October. Her presentation provided an excellent overview of many important considerations for producers and practitioners alike. A selection of particularly useful considerations and important reminders are provided below. For those of you who want to take a deep dive into all things small ruminant check out the Small Ruminant edition of Veterinary Clinics: Food Animal Practice (Vol. 37, Issue 1, March 2021):

- Not all medications are tolerated as well in small ruminants as in cattle. The body mass of small ruminants makes lidocaine toxicity which can occur at dosages >6-10 mg/kg a significant concern. Dilution of 2% lidocaine 1:1 with sterile water immediately prior to use is helpful to decrease the risk of toxicity.

- Small ruminants are also very sensitive to the sedative effects of xylazine, and very low dosages are recommended (0.01-0.05 mg/kg IV). Dilution to a 1-2 mg/mL solution using sterile water is highly recommended to avoid dosing errors.
- Differences also exist between sheep and goats themselves in terms of the safety and efficacy of certain medications. For example, tilmicosin is labeled for use in sheep for treatment of respiratory disease but should not be used in goats as it has been shown to cause fatal reactions.
- The half-life of many drugs that undergo hepatic metabolism also differ greatly between sheep and goats. Due to this difference, recommended dosing of anthelmintics in goats is generally 1.5 times (levamisole) to 2.0 times (benzimidazoles, avermectins) the ovine anthelmintic dose.
- Pregnancy diagnosis via transabdominal ultrasound to stage pregnancies and count the number of fetuses is a key tool in prevention of pregnancy toxemia as it allows for improved feeding management of groups of animals. Transabdominal ultrasound from 45 to 85 days of age provides the most accurate window for both positive identification of pregnancy as well as fetal counting and staging, particularly for practitioners that don't perform this service on a regular basis.
- Design of vaccination schedules for small ruminants and camelids is often simplified compared to cattle due to the overall decreased number of available labeled vaccines. All small ruminants should receive an initial two-dose series of a clostridial vaccine containing at minimum Clostridium perfringens C and D plus tetanus toxoid with a yearly booster.
- Although intranasal modified live viral respiratory disease vaccines from cattle have been anecdotally used in an attempt to control pneumonia in sheep and goats, previous research on this topic (Thonney et al. 2008. *Small Ruminant Research*. 74, 30-36) did not show success at pneumonia prevention with this practice.
- Recommended timing of castration differs depending on the intended use of the animal. From a pain perspective, early castration around the time of birth via banding for animals destined for meat production likely provides the best pain mitigation. Testicular development in small ruminants is rapid compared to overall body size; therefore, banding of older animals quickly becomes problematic particularly due to a high susceptibility to tetanus. Nonetheless, for animals destined to be pets research suggest that delaying castration until 3 months of age may be beneficial in increasing urethral diameter, potentially decreasing the risk of obstructive urolithiasis.
- Urolithiasis should be at the top of the differential list for any sick call involving a male small ruminant. Owners frequently report that the animal appears constipated, is vocalizing or posturing abnormally, has gone off-feed, or is dribbling urine. Pet wethers are highly prone to this condition due to a smaller urethral diameter, excessive caloric intake, and poorly balanced diets. Standard physical examination of any male small ruminant should therefore involve digital rectal palpation to evaluate for pulsatile contractions of the urethra and observation of normal urination; abdominal ultrasound is also very useful to identify an enlarged urinary bladder. Amputation of the urethral process under sedation is the first step in attempting to relieve urethral obstruction. For many animals, this will alleviate the initial blockage, but further treatment may be necessary to prevent reoccurrence. For animals on a high concentrate diet, struvite uroliths are the most common type of stone seen in cattle, sheep and goats. These stones are degradable under conditions of urinary acidification; therefore, administration of ammonium chloride maybe be beneficial in dissolving stones are preventing reoccurrence. Keep in mind that although many commercial diets for small ruminants contain ammonium chloride, the inclusion rate is not high enough to achieve adequate acidification, and similar to dairy cattle, compensation occurs over time leading to decreased efficacy. Pulse feeding of 90-200 mg/lb/d (200-450 mg/kg/d) PO for one week per month is currently recommended for treatment and/or prevention of phosphatic stones in sheep and goats.
- The highest risk period for negative energy balance in sheep and goats is immediately prior to parturition during the last month of gestation and can lead to pregnancy toxemia. Pregnancy toxemia is most commonly seen in animals that are either too thin or obese, have >1 fetus, or have another underlying condition leading to decreased feed intake. Diagnosis of pregnancy toxemia is similar to diagnosis of ketosis in cattle using a handheld β-hydroxybutyrate (BHBA) meter. Current research suggests that a cutoff of 0.7 mmol/L is

suggestive of hyperketonemia and above 1.0 mmol/L is high risk for significant hyperketonemia in sheep and goats. These values are much lower than the recommended cutoff for subclinical ketosis in dairy cattle of >1.2-1.4 mmol/L. Treatment of pregnancy toxemia is typically based on two goals: 1) to provide increased energy sources and 2) to decrease the factors causing the negative energy balance.

Cattle: A Systems Approach to Beef Management

By CS McConnel, Veterinary Medicine Extension

Dr. Frank Garry from Colorado State University provide several excellent presentations to the WSVMA Pacific Northwest Veterinary Conference this past October. Of particular note was his presentation regarding the development and use of beef herd metrics based on a systems approach. Systems thinking is a problem-solving methodology that provides for the study of how systems work. It offers frameworks and tools that can be used to develop more effective strategies for effective change. These frameworks and tools help users recognize hidden and unintended consequences, as well as think deeper and wider about complex systems. Obviously, beef management systems vary between extensive and intensive, year-round breeding versus seasonal, and input levels related to cost versus investment; however, the value of calves sold per breeding female as compared to the cost of producing those calves remains the important issue. Increasing herd income (e.g., enhancing reproductive and growth efficiency), helping to control costs (e.g., nutrition and other input cost counseling), and protecting the herd from biologic and economic losses (e.g., disease and injury) are all areas where producers and veterinarians can work together to increase return on investment.

At the heart of a systems approach is the Iceberg Concept. The iceberg represents the problem that is being addressed and, as is typical for icebergs, only about 10% of the iceberg/problem is readily visible above the waterline. In order to correct the problem, one must understand the driving forces and pressures that exist in the 90% of the problem that is unseen (below the waterline). This requires embracing the entire problem by learning about the unseen factors through data acquisition. Data related to herd metrics provide the framework for monitoring outcomes related to profitability. These data depend on the incorporation of assessment tools capturing performance, losses, risk factors and disease. External benchmarks regarding industry standards and averages, and internal benchmarks related to current or previous performance can help monitor improvement. For example, overall pregnancy outcomes do not necessarily drive optimum profitability and must be viewed in light of the timing of pregnancies, 20-day intervals, and other descriptors such as age, bulls, infectious disease, pastures and breeds. These factors ultimately influence drivers of success related to maximizing calf growth and replacement heifers, optimizing calf health and nutritional resources, and improving calf marketing and the use of labor resources.

So, what data should be collected, and when, in order to make progress? According to Dr. Garry, good data collection typically will require about 6 evaluations per year. These evaluations integrate into activities associated with the cow/calf production calendar such as: calving, bull breeding soundness exams, female BCS measurements, processing and culling, feed analysis, replacement heifer soundness exams, estrus synchronization, cow and replacement heifer breeding, and vaccinations for calf protection, preconditioning, and replacement heifers. Given the variations inherent to different production calendars, the following Figures are only models but provide a perspective based on an April 1st calving date for the adult cow herd. **Figure 1** demonstrates a basic production calendar, **Figure 2** integrates opportunities for evaluations and data acquisition, and **Figure 3** provides an overview of replacement heifer management. Clearly, capturing this data requires a strategy for coordinating information gathering with ranch activities. Furthermore, it requires a strategy for organizing and analyzing the data in the most efficient and effective way possible (check out the article below regarding Evidence-Based Veterinary Medicine for some additional insight into assessing data). Hopefully considering the system as a whole will provide you with novel insight that benefits everyone involved!

Figure 1: Cow/calf production calendar

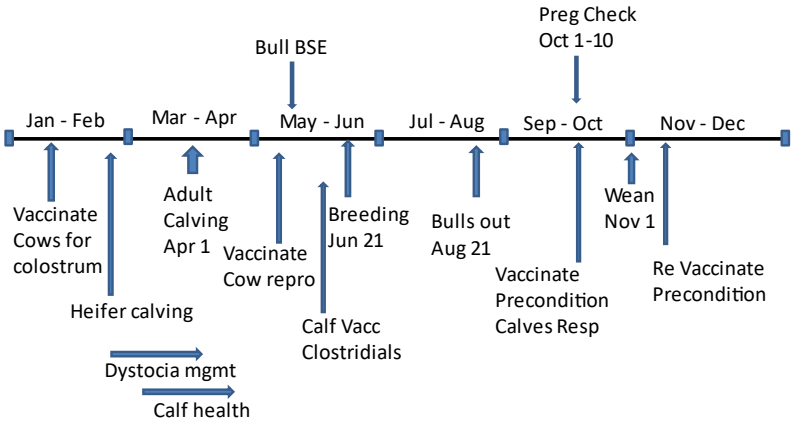


Figure 2: Cow/calf production calendar with evaluations and data acquisition

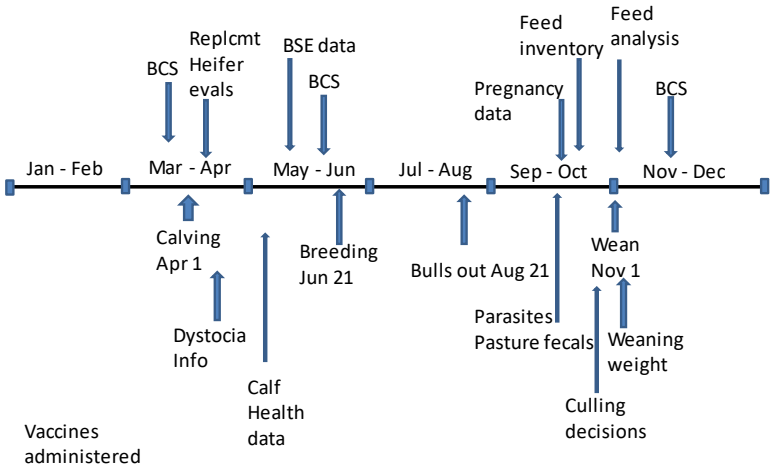
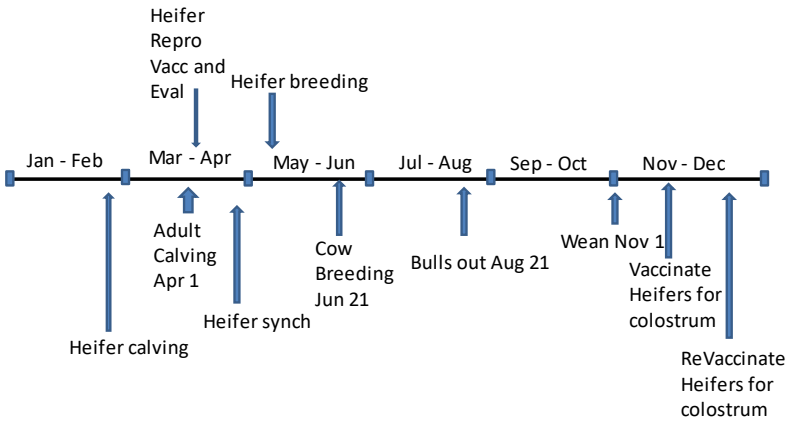


Figure 3: Cow/calf production calendar with replacement heifer management



Dairy: Sulfonamide Use

By CS McConnel, Veterinary Medicine Extension

A recent conversation about managing coccidiosis in a dairy setting led down the rabbit hole regarding the use of sulfonamides on a dairy farm. The Minnesota Department of Agriculture has an excellent 2-page fact sheet available that you might want to check out, which includes information relevant to sheep and goat dairies. It also includes a useful Table covering FDA-approved uses of sulfonamide drugs by cattle class. The primary take-home message is that 'sulfa drugs' can only be used exactly according to their label instructions in lactating dairy cattle, which means that sulfadimethoxine is the ONLY formulation that meets this criterion. For a refresher on drugs that are prohibited for extralabel use in food-producing animals you can check out this Code of Federal Regulations website and scroll down to the bottom of the page to find '530.41 Drugs prohibited for extralabel use in animals.'

Swine: Understanding PRRS 1-4-4

By CS McConnel, Veterinary Medicine Extension

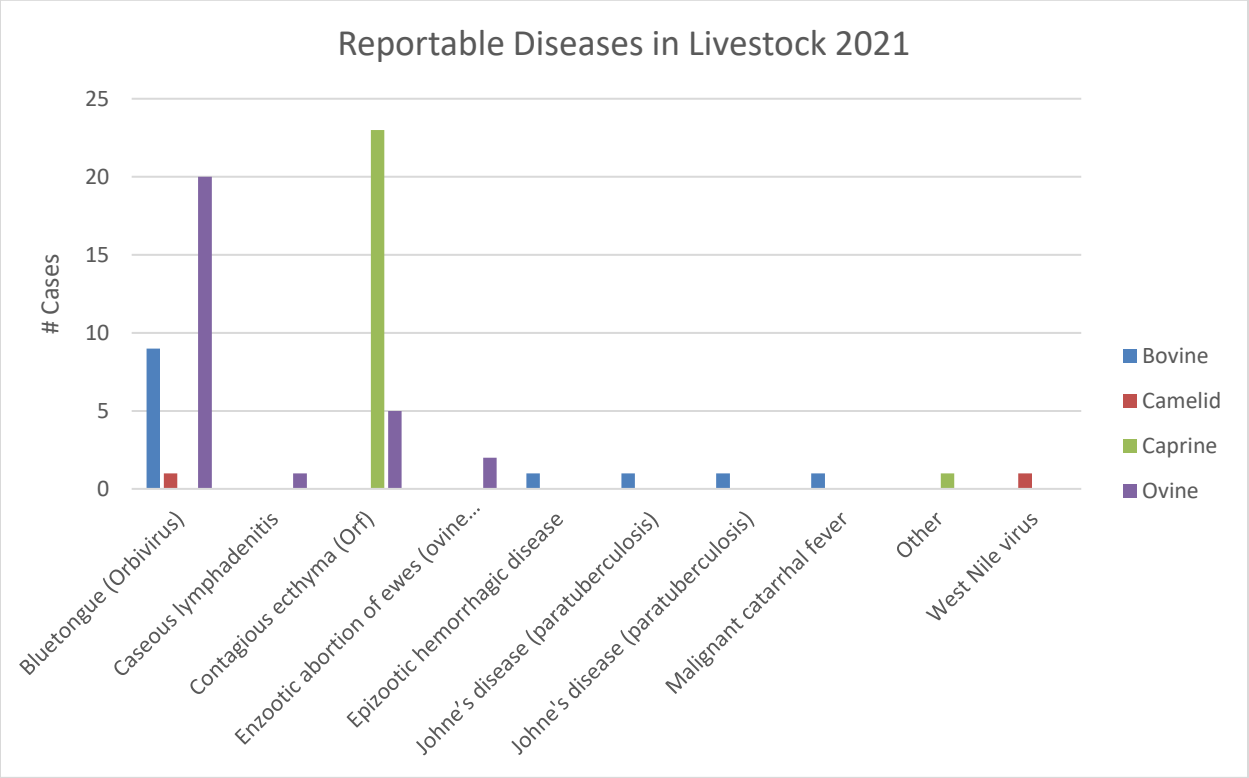
If you have even a casual interest in swine industry news, you will know that African Swine Fever is a pressing concern. However, you may not have heard about the relatively new strain of Porcine Reproductive and Respiratory Syndrome (PRSS). This new 1-4-4 Lineage 1C strain emerged in early 2020 in the US and was the topic of a recent Pork Checkoff article and associated webinar. PRRS is a disease characterized by two overlapping clinical presentations: reproductive impairment or failure and respiratory disease in pigs of any age. The virus spreads by nasal secretions, saliva, feces and urine, and it can be airborne for up to two miles. PRRS 1-4-4 is an unusual strain in that infections peak in spring/summer, as well as fall/winter months, compared to other strains that typically only peak in fall/winter months. To date, it appears that the majority of PRRS 1-4-4 Lineage 1C isolates have been detected in Minnesota, Iowa, Illinois, South Dakota and Wisconsin. It has been detected in breeding and growing herds, vaccinated and non-vaccinated herds, along with filtered farms and even highly biosecure multiplier sites. According to Dr. Lisa Benton, director of animal health at the National Pork Board, PRRS does well in cold, damp conditions and in the presence of organic material.

Nonetheless, research conducted at the University of Minnesota Morrison Swine Health Monitoring Program suggests that the PRRS 1-4-4 is controllable with consistent and strict biosecurity efforts. Although aerosols and feed are risk factors for PRRSV 1-4-4 spread, filtration and feed mitigation reduce that risk. Furthermore, modified live vaccines have been shown to be effective. Overall, 6 important biosecurity steps have been outlined to help prevent the spread of PRRS 1-4-4 as follows:

1. Winterize barns to minimize temperature swings and mitigate temperature stress on animals.
2. Ensure heaters, fans, curtains are all in working condition.
3. Manage manure handling practices and be aware of where manure is applied and if people (contractors or animal handlers) are crossing that ground.
4. Manage a strict line of separation inside and outside the farm. Disease transmission can occur through personnel/equipment movements.
5. Establish protocols for downtime/tracking of people and equipment.
    a. Park equipment offsite for downtime.
    b. Wear disposable boots when within 20-30 feet of barn.
6. Clean and disinfect equipment including hoses, reels, tractors, vehicles or ATV's — anything used on the farm.
    a. Remove organic material – disinfection only works on clean surfaces.
    b. Follow labels for disinfectant on people and equipment.

WSDA: Disease Trends for 2021

By Amber Itle, Interim WA State Veterinarian



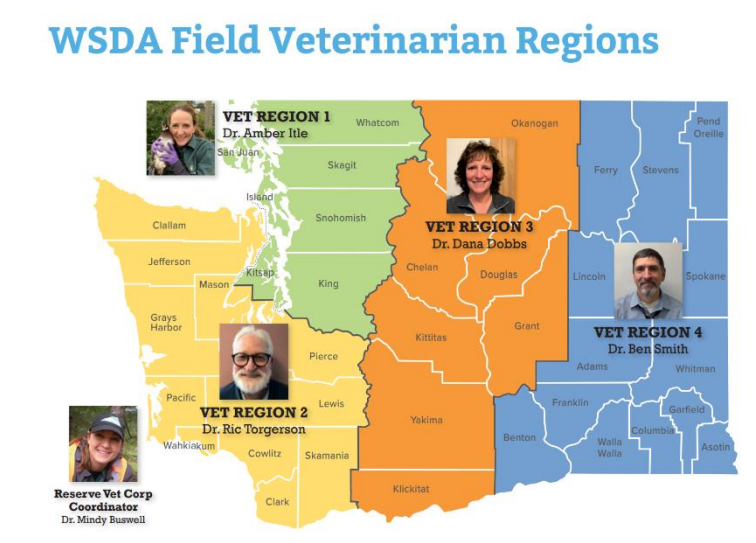
Happy New Year! To wrap up 2021, I thought I would collate some data to look at livestock disease trends in Washington. We tend to get the most reports from companion animals, poultry and equine veterinarians. Once I pulled that data out, you can see that we had very few cases of disease reported from the livestock sector this year, making it hard to identify trends across the state.

You probably know that licensed veterinarians and veterinary laboratories are required to report foreign animal diseases to the State Veterinarian. Did you know that vets and laboratories in Washington will soon be required to report new, emerging, and unusual animal diseases too? New, emerging, or unusual animal diseases are those that have 1) never or rarely been observed in Washington State or appear in a new species, or 2) show evidence of higher pathogenicity, mortality or morbidity than expected, or 3) appear in a higher-than-expected number of animals clustered in time or space. This will help us inform veterinarians across the state when we detect new or more virulent pathogens. For example, in recent years in WA we have seen more virulent strains of equine influenza that demonstrate high morbidity. We also might detect the next pathogen responsible for a zoonotic pandemic. Let's hope not, but that is the intention of the additional language.

It can be difficult to keep track of what's reportable and also can be confusing since some diseases are reportable and monitored for disease trends and some are reportable and actionable by state animal health officials. Some diseases such as Johne's, salmonellosis or leptospirosis are tracked primarily in an effort to monitor state trends. Other common endemic diseases such as contagious ecthyma (ORF), bluetongue or malignant catarrhal fever are reportable because they look like foreign animal diseases and cannot be ruled out without routine diagnostics. It's better to be safe than sorry--you certainly do not want to be named in the veterinary history books as the veterinarian that missed the first case of FMD in the country! We all know that endemic and foreign animal diseases can look alike and the only way to rule them out is through appropriate diagnostics.

Just a quick reminder that if you see any clinical signs consistent with a foreign animal disease or if you see something that just doesn't seem right, don't hesitate to reach out to the State Vet's office. Veterinarians should report any highly unusual clinical signs such as mouth or muzzle lesions, especially if accompanied by foot, udder, vulva or skin lesions that resemble blisters or vesicles. This broad language gives us the best chance of identifying foot and mouth disease quickly. There is also a requirement to report any encephalitis (CNS) conditions in all animals for early identification of diseases with public health significance such as rabies or TSE-associated diseases. It is very easy to report on our Reportable Animal Disease (RAD) Platform . . . it's RAD and so are you if you use it!

Make sure you know who your regional field veterinarian is and get them in your speed dial. All of our field vets are trained as foreign animal disease diagnosticians and are even fun to work with! They can provide free consulting and on farm sampling to rule out FAD. Let's do better to track livestock disease trends in WA this year so we can make better, informed decisions in the field. Happy New Year . . . the year of the Diagnostic Challenge!



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WSDA: 'Carcass Management Preparedness' Training

Amber Betts, WSDA Communications

Animal disease outbreaks, natural disasters, and technological emergencies threaten animal agricultural production in the United States. The potential impact on Washington's economy from a disease outbreak in animal agriculture operations could be devastating.

But a recent grant from the U.S. Department of Agriculture could help WSDA be better prepared. Recently, the USDA Animal and Plant Health Inspection Service (APHIS) National Animal Disease Preparedness and Response Program (NADPRP) awarded WSDA $194,366 to launch the Carcass Management Preparedness Train-the-Trainer program.

Preparing for and responding to foreign animal diseases (FADs) are critical actions to safeguard the nation's animal health, food system, public health, environment, and economy. WSDA is the lead state agency in responding to domestic animal disease emergencies in Washington state. We work with federal, state, and local government agencies, educational institutions, industry organizations and animal producers to ensure adequate preparation.

If euthanasia is required due to FAD, proper carcass management is a critical tool to contain an outbreak and maintain food security. In Washington state alone, thousands of large animals, mostly dairy and beef cows, died in the winter of 2019 due to extreme blizzard conditions, and many died in the summer of 2021 due to extreme heat conditions. While not an FAD outbreak, those two events highlighted several gaps in Washington state's ability to respond to emergency carcass management needs in the event of an FAD:

- Lack of comprehensive emergency mortality management plans at livestock operations.
- Limited availability of subject matter experts who understand Washington's incident command structure and can provide technical assistance to livestock owners.

WSDA will work in partnership with Washington State University (WSU) to develop the Carcass Management Preparedness Train-the-Trainer Programs for Animal Agriculture Sector Responders in the Northwest.
APHIS provided $7.6 million for 36 projects across the country that are focused on (1) developing vaccination plans for FAD outbreaks, (2) supporting animal movement decisions in an FAD outbreak, or (3) delivering outreach and education on animal disease preparedness and response topics to targeted audiences.

The WSDA and WSU training will include multi-day demonstrations on mortality management, composting, above ground burial, and the use of grinding equipment. The project is developing guidance documents, best management practices, and a training framework. Materials will be available on a centralized mortality management resource public webpage to help all livestock agricultural professionals.

The target audience for the training, educational resources, and mapping tools include state and federal animal health officials, local emergency managers, veterinarians, extension agents, and other ag sector responders. Developing this cadre of subject matter experts will prepare Washington to respond and strengthen outreach and education on animal disease prevention, preparedness, and response.

Officials are currently in the process of developing a training plan, including the dates, times, and locations of the trainings, expected to roll out this spring. For more information on the program, contact interim state veterinarian Dr. Amber Itle or WSDA's Emergency Management program manager Erin Coyle. You can also visit our webpages for Animals Services or Emergency Management.

WSDA: New FMD Vaccine Technology Could Allow for Domestic Vaccine Production

By Dr. Amber Itle, Interim WA State Veterinarian

Foot and Mouth Disease (FMD) is a highly contagious viral disease of all cloven hooved animals including cows, sheep, pigs, goats, and deer. When many of us think about FMD, images from the outbreak in England two decades ago are still burned into our memories. We think about piles of burning carcasses. We think about tearful producers and escalating suicide rates. We think about complete economic devastation and lack of consumer confidence. We think about an end to animal agriculture as we know it.

The "stamping out" practice that requires euthanasia of all animals in a geographic region has been replaced with the idea that we can use emergency vaccination strategies to contain, control and prevent the spread of disease. The three FMD vaccine complexities include antigenic diversity, production locale and novel technologies. In 2018, the Farm Bill allocated $150 million towards improved disease preparedness. This will create a new U.S. dedicated National Animal Vaccine and Veterinary Countermeasures Bank in hopes of

expanding capabilities. However, the live FMD vaccine banks must be located off of the U.S. Mainland per federal law, thus limiting surge production capability.

FMD is an RNA single stranded virus with lots of diversity in serotypes. Subtypes may or not be cross protective, making stockpiling difficult and a guessing game at best. There are seven distinct serotypes of the FMD virus and more than 60 sub-types or strains. In order for emergency vaccination to be effective, the FMD vaccine must match the field strain. There is a new, promising, attenuated platform for domestic FMD vaccine production. Zoetis petitioned APHIS in 2020 to approve the manufacture of the vaccine on the US mainland. Some of you may know that this is same technology that was used for the Johnson and Johnson Covid-19 vaccine. In the early 2000s, genetic studies found that taking out the leader protease or the first protein on the genome made it less contagious in animals, while it still grew well in culture. The leader protease can be used to safely construct an inactivated modified strain vaccine that swaps out the genetic coding for the structural strain. In other words, the backbone is avirulent in animals and could be swapped out to make structural vaccines for different strains.

Leader protein deletion is significant to the virus' ability to antagonize host environmental effects. Cell cultures show no evidence of reversion or instability. Sequence deletions after animal inoculations in *in vivo* and *in vitro* modifications have been shown to be stable. In both bovine and swine studies of various exposure and administration routes, no FMD virus could be recovered, and no clinical signs were exhibited. The bottom line is that without the leader protein the virus cannot replicate in animals, has genetic stability, and safety studies using the live virus with adjuvant/non-adjuvant forms have demonstrated no adverse effects or recombination ability. This means that attenuated strains can be pulled from the select agent list and might allow the vaccine to be stored and produced on the U.S. mainland. Furthermore, the "leaderless" vaccine has two deleted non-structural protein genes in the backbone (3B and 3D) that allows for diagnostic markers to be inserted. These insertions allow for the vaccine to be differentiated from the virulent field strain. This ability to differentiate infected and vaccinated animals is critical, in that it focuses response efforts and reduces the ambiguity of test results.

WSDA: Show Me the Money! Veterinary Shortage Areas Open Doors to Loan Forgiveness and Veterinary Service Grants

By Dr. Amber Itle, Interim WA State Veterinarian

Are you drowning in student debt? Are you having trouble recruiting or retaining veterinarians? Are you trying to retire and can't find a veterinarian to take over the practice? If you answered 'yes' to any of the above, applying for the Veterinary Medicine Loan Repayment Program (VMLRP) may help you reduce debt load or may help attract veterinarians to your practice.

The Washington State Vet's office successfully nominated four veterinary shortage areas opening the door for both VMLRP and the Veterinary Services Grant Program. The shortage areas include Clallam, Adams, Franklin, Douglas, Grant, Lincoln, Asotin, Columbia, Garfield, and Walla Walla counties.

A successful application to the VMLRP helps qualified veterinarians offset up to $25,000 of student loan debt per year in return for their service in certain high-priority veterinary shortage situations. You don't have to be a new graduate to apply for loan forgiveness. You also don't have to have student loan debt to benefit. The shortage area designation also allows veterinary practices to apply for funds to expand service capability and capacity (e.g., new mobile unit, ultrasound, etc.).

The application period is from Feb 1, 2022- April 15, 2022. More information about both programs can be found in the links above or email questions to: VMLRP@usda.gov or VSGP@usda.gov.

New Year's Resolutions for Livestock Veterinarians

By Dr. Amber Itle, Interim WA State Veterinarian & CS McConnel, Veterinary Medicine Extension

A New Year provides a great opportunity to rethink how we do things and make plans for improvement. Here are a few ideas to get you started . . .

1. Discuss heat mitigation strategies with your clients. Updating and improving facilities to lessen the impact of severe heat stress should be done well in advance of spring work and summer temperatures.
2. Prepare for pinkeye season. Discuss preventive, diagnostic, and therapeutic options with your producers now rather than waiting for the first cases to show up this spring.
3. Talk to your producers about testing hay to know the nutritive value and how the hay will contribute to meeting cattle nutritional requirements. This is especially important this year given the difficulty some producers had acquiring good-quality hay.
4. Be on the lookout for Abortion, Stillbirth, Premature and Weak calves (APSW complex—formerly known as Weak Calf Syndrome) given the harsh winter conditions thus far and the potential for hay that is of a lesser quality than normal.
5. Consider conducting a value proposition with your clients. Even better, help WSU veterinary medicine extension understand what you have learned about your clients' needs and how we can help support your value proposition by filling out this short survey!
6. Help your client write a Farm Biosecurity Plan. Disease prevention is far more effective than treatment or lost productivity associated with a disease outbreak. Farm Biosecurity or Secure Food Supply plans help your client identify and mitigate high risk practices that are most likely to introduce disease. Enhanced biosecurity plans also can be used during something as serious as a Foot-and-Mouth disease outbreak to allow for continuity of business and permitted product movement. WSU and WSDA are looking for veterinarians willing to pilot this effort with veterinary students this summer. Let us know if you are interested.
7. Offer Breeding Soundness Exam (BSE) for bulls. Help your clients understand the importance bull fertility on herd health and profitability. A BSE consists of an exam of the reproductive organs and semen evaluation to help ensure fertility and freedom from Trichomoniasis.
8. Revisit and update vaccination programs and farm SOPs you have written and check on compliance. Pay special attention to SOPs that are important to animal welfare such as down cow SOPS, euthanasia SOPs, dehorning SOPs, and treatment SOPs. Take an active role in the FARM program audits. Help your dairies become compliant. As the farm veterinarian, you are the professional steward of animal care and can help producers make meaningful changes to improve farm animal welfare.
9. Embrace technology. Get FREE handheld RFID tags and readers for regulatory work from the State Vet's Office. Sign up to use free electronic health certificates.
10. Consider the importance of mental Wellness and Work Life Balance. Veterinary medicine is a stressful occupation with high rates of suicide. Consider hiring additional veterinarians in your practice or taking advantage of the recently nominated shortage area opportunities for student loan repayment through the Veterinary Medical Loan Repayment Program.

WSU CVM Senior Paper Highlights

Use of thoracic ultrasound in diagnosis of bovine respiratory disease in dairy calf heifers
By Dakota Cameron (Advisor: Dr. Craig McConnel)
Summary: Bovine Respiratory Disease (BRD) Complex is a multifactorial disease resulting from a combination of bacterial and viral pathogens and is the most important cause of morbidity and mortality in dairy cattle operations. BRD is most frequently seen in calves between the ages of 1 and 5 months of age. Poor growth, decreased milk production, and reproductive performance, along with increased cull rates are all negative sequelae associated with BRD.

Improved understanding of the diagnosis, course, risk factors, and detrimental effects of the disease is import in preventing and reducing morbidity and mortality associated with BRD. Historically, respiratory scoring charts have been used in diagnosing BRD which assign a score to individual calves based on the severity of clinical signs. Recently, the use of thoracic ultrasonography has gained increased interest as a more accurate way of detecting lung lobe lesions in calves with clinical and subclinical BRD. This data may be collected and used to guide management and culling decisions; however, further research is warranted to determine how thoracic ultrasound scores can be used to guide therapeutic interventions including antimicrobial therapy.

Small ruminant parasitism - A review of current treatment options and effective management strategies of abomasal nematodiasis
By Taylor Robbins (Advisor: Dr. George Barrington)
Summary: Management of nematodiasis (infection with a nematode species) in small ruminants is one of the most economically important challenges facing the small ruminant industry in the United States today. An increase in the incidence and degree of drug-resistance in abomasal nematodes (the “HOT” complex nematodes) has necessitated major changes in management strategies and de-worming protocols over the last 20 years. Many alternative therapeutics and “natural” (herbal) therapies have been explored and have largely been shown to be ineffective, more expensive than is practical, or simply unavailable in the United States. Today, the current gold standard is to advise owners and producers to focus on improved management strategies in combination with judicious, targeted anthelmintic treatment of only clinically affected animals.

The challenges and importance of understanding calfhood disease within a dairy herd
By Sidney Jones (Advisor: Dr. Craig McConnel)
Summary: The main objective for this study was to describe the incidence of calfhood disease seen by two dairies based on previous records from a digital record keeping system. The calves studied were then followed through their first and second lactation to gather additional data on reproduction, health, and production parameters. The secondary objective was to use this information to determine the economic impact and welfare effect that calfhood disease can have within a dairy herd. A retrospective cohort study was designed and two commercial dairy herds from central Washington were included, both with different herd sizes and management practices. Data was compiled based on records from calves born between 5/1/15 and 4/30/17 and consisted of identification, disease events, reproduction parameters, production parameters, and death or removal from herd information from birth through May 2021. For Herd A, a Holstein dairy with approximately 2,300 lactating cows and 2,147 calves were enrolled. For Herd B, a mixed dairy of Holsteins and Jerseys with approximately 11,300 lactating cows and 11,987 calves were enrolled. All data was compiled from the herd management software at use on the farm and once compiled, RStudio was used for descriptive statistics and analysis of the data. Results showed an incidence rate of 10.66% for scours and 3.63% for bovine respiratory disease (BRD) for Herd A during the preweaning stage. For Herd B, there was an incidence rate of 14.32% for scours and 43.64% for BRD during the preweaning stage. These incidence rates vary between herds as well as with nationally

reported values, speaking to the difficulties in using historical records for defining disease. There was not an obvious effect of pneumonia on age at first calving, although statistical analysis was not performed. Additionally, little to no association was found between preweaning disease and disease during the first lactation or ability to enter first lactation. These results indicate further exploration of the data is needed to define the economic impact and welfare effect, as management decisions often take calf disease into consideration, which may not have the economic or welfare effects as expected.

Difference in pregnancy rates in beef heifers based on time of insemination post onset of estrus utilizing Y-sorted SexedULTRA-4M semen

By Katherine Madsen (Advisor: Dr. Ramanathan Kasimanickam)

Summary: In a beef cattle operation, the quantity and quality of beef are the drivers in success. This makes the producers strive for efficiency and advancing their programs. In the last few decades, the use of artificial insemination has increased immensely, but in the last few years there has been a pronounced increase in the utilization of sexed-semen. This started in the dairy industry to capture selected female genetics while decreasing the number of the undesired male calves and now featuring superior steer calves for the beef industry.

The main reason the beef industry has not completely signed on for sexed-semen insemination is due to the following: decreased fertility rates compared to conventional semen, increased cost of sexed semen straws, increased cost of possible re-insemination for higher number of cattle which all come with the additional risk to the cow itself of artificial insemination, and time. Time is money. To make-sexed semen more comparable to conventional semen, SexedULTRA semen has mitigated several decreased fertility issues, revamped their methods, and increased the dosage of semen.

Similar studies performed on dairy cattle resulted in an increase in pregnancy rates per artificial insemination at 20 hours versus 12 hours post estrus. Hence the reason for this study to evaluate if insemination at 12 hours post onset of estrus versus 20 hours post onset of estrus would show the same trend of increased pregnancy rates per AI at a later insemination hour. If there is an advantage, producers gain higher pregnancy rates being even more comparable with conventional semen.

WSU Ag Animal Faculty Research Updates

1. Fecal microbiome profiles of neonatal dairy calves with varying severities of gastrointestinal disease

GS Slanzon, BJ Ridenhour, **DA Moore**, **WM Sischo**, **LM Parrish**, **SC Trombetta**, **CS McConnel**

DOI: https://doi.org/10.1371/journal.pone.0262317

Abstract: Gastrointestinal disease (GI) is the most common illness in pre-weaned dairy calves. Studies have associated the fecal microbiome composition with health status, but it remains unclear how the microbiome changes across different levels of GI disease and breeds. Our objective was to associate the clinical symptoms of GI disease with the fecal microbiome. Fecal samples were collected from calves (n = 167) of different breeds (Holstein, Jersey, Jersey-cross and beef-cross) from 4–21 d of age. Daily clinical evaluations assessed health status. Calves with loose or watery feces were diagnosed with diarrhea and classified as bright-sick (BS) or depressed-sick (DS) according to behavior. Calves with normal or semiformed feces and no clinical illness were classified as healthy (H). One hundred and three fecal samples were obtained from consistently healthy calves and 64 samples were from calves with diarrhea (n = 39 BS; n = 25 DS). The V3-V4 region of 16S rRNA gene was sequenced and analyzed. Differences were identified by a linear-mixed effects model with a negative binomial error. DS and Jersey calves had a higher relative abundance of *Streptococcus gallolyticus* relative to H Holstein calves. In addition, DS calves had a lower relative abundance of *Bifidobacterium longum* and an enrichment of

Escherichia coli. Species of the genus *Lactobacillus*, such as an unclassified *Lactobacillus*, *Lactobacillus reuteri*, and *Lactobacillus salivarius* were enriched in calves with GI disease. Moreover, we created a model to predict GI disease based on the fecal microbiome composition. The presence of *Eggerthella lenta*, *Bifidobacterium longum*, and *Collinsella aerofaciens* were associated with a healthy clinical outcome. Although lactobacilli are often associated with beneficial probiotic properties, the presence of *E. coli* and *Lactobacillus* species had the highest coefficients positively associated with GI disease prediction. Our results indicate that there are differences in the fecal microbiome of calves associated with GI disease severity and breed specificities.

2. Cows as canaries: The effects of ambient air pollution exposure on milk production and somatic cell count in dairy cows.

Beaupied BL, Martinez H, Martenies S, **McConnel CS**, Pollack IB, Giardina D, Fischer EV, Jathar S, Duncan CG, Magzamen S.

DOI: 10.1016/j.envres.2021.112197

Abstract: Exposure to air pollution, including criteria pollutants such as fine particulate matter ($PM_{2.5}$) and ozone (O_3), has been associated with morbidity and mortality in mammals. As a genetically homogenous population that is closely monitored for health, dairy cattle present a unique opportunity to assess the association between changes in air pollution and mammalian health. Milk yield decreases in the summer if temperature and humidity, measured by the Temperature Humidity Index (THI). As O_3 levels increase with warmer temperatures, and summer $PM_{2.5}$ may increase with wildfire smoke, dairy cows may serve as a useful sentinel species to evaluate subacute markers of inflammation and metabolic output and ambient pollution. Over two years, we assessed summertime O_3 and $PM_{2.5}$ concentrations from local US EPA air quality monitors into an auto-regressive mixed model of the association between THI and daily milk production data and bulk tank somatic cell count (SCC). In unadjusted models, a 10 unit increase THI was associated with 28,700 cells/mL (95% CI: 17,700, 39,690) increase in SCC. After controlling for ambient air pollutants, THI was associated with a 14,500 SCC increase (95% CI: 3,400, 25,680), a 48% decrease in effect compared to the crude model. Further, in fully adjusted models, $PM_{2.5}$ was associated with a 105,500 cells/mL (95% CI: 90,030, 121,050) increase in SCC. Similar results were found for milk production. Results were amplified when high $PM_{2.5}$ days (95th percentile of observed values) associated with wildfire smoke were removed from the analyses. Our results support the hypothesis that $PM_{2.5}$ confounds the relationships between THI and milk yield and somatic cell count. The results of this study can be used to inform strategies for intervention to mitigate these impacts at the dairy level and potentially contribute to a model where production animals can act as air quality sentinels.

3. In-vitro antibiotic resistance phenotypes of respiratory and enteric bacterial isolates from weaned dairy heifers in California

Depenbrock S, Aly S, **Wenz J**, Williams D, ElAshmawy W, Clothier K, Fritz H, McArthur G, Heller M, Chigerwe M.

DOI: 10.1371/journal.pone.0260292

Abstract: Antimicrobial drug (AMD) use for bovine respiratory disease (BRD) continues to be concerning for development of antimicrobial resistance (AMR) in respiratory and enteric bacteria of cattle. This study aimed to provide data regarding AMR in respiratory isolates, and identify relationships between respiratory and enteric AMD susceptibility, in weaned dairy heifers. A cross-sectional study was performed between June of 2019 and February 2020, on 6 calf rearing facilities in California. Deep nasopharyngeal and rectal swabs were collected from 341 weaned heifers and submitted for selective bacterial culture and AMR testing. *Mannheimia haemolytica*, *Pasteurella multocida*, and *Histophilus somni* were selectively isolated from respiratory samples; *Escherichia coli* and Enterococcus spp. were selectively isolated from rectal swabs. Minimum inhibitory concentrations (MIC) were determined for selected isolates against 19 AMD. The proportion of resistant isolates was calculated using Clinical Laboratory Standards Institute (respiratory) or USDA NARMS (enteric) breakpoints; when no applicable breakpoint was available, the distribution of MIC was described and compared. Association between AMR in a calf's respiratory isolate and a higher or lower MIC of the matched enteric isolates was

determined. More than 50% of *P. multocida* isolates were resistant to each of 7 AMD commonly used to treat BRD (florfenicol, gamithromycin, tildipirosin, tilmicosin, danofloxacin, enrofloxacin and tetracycline). Resistance in respiratory isolates was only associated with higher matched enteric MIC for gamithromycin and tulathromycin. Multidrug resistance was reported in >70% of *P. multocida* and *M. haemolytica* isolates. Antimicrobial resistance, including multidrug resistance, in respiratory isolates appears to be widespread in weaned dairy heifers; this finding has not previously been reported and raises concern for the future efficacy of AMD used to treat respiratory diseases in weaned dairy heifers. Enteric bacterial MIC appear to have limited direct association with respiratory isolate AMR classification.

4. Pregnancy and offspring sex ratio following insemination with SexedULTRA and conventional semen in cows in a commercial beef operation

Kasimanickam R, Kasimanickam V, Ratzburg K.

DOI: 10.1111/rda.14008

Abstract: Pregnancy rate per AI (PR/AI) and breeding season pregnancy rates between insemination with sexed semen (SS; at 18 hr after the onset of oestrus) and conventional semen (CS; at 12 hr after the onset of oestrus,) and offspring gender ratio between two groups were compared. Angus cross cows (n = 686, during 2019 and 2020 breeding seasons) were oestrus-synchronized using Select-Synch + CIDR protocol and were observed thrice daily for oestrus until 72 hr after PGF2α administration. Cows expressed oestrus (n = 513) were inseminated with either SS (n = 246; SexedULTRA 4M™; y chromosome-bearing sperm) or CS (n = 267). Cows (n = 173) that failed to express oestrus at 72 hr after PGF2α received 100 μg of GnRH and CS insemination concomitantly. Two weeks later, cows were penned with natural service sires (bull:cow ratio 1:25) for 45 days. Pregnancy was diagnosed 30 days after bull removal. Calves' gender was determined at birth. For cows that expressed oestrus, PR/AI did not differ ($p > .1$) between SS (65.0%) and CS (66.7%) groups. The overall PR/AI differed ($p < .05$) between SS (65.0%) and CS (56.4%) groups. The natural service PR differed ($p < .001$) but breeding season PR ($p > .05$) did not differ between SS vs. CS groups. Bull:heifer gender ratio following AI was 88:12 and 52:48 for SS and CS groups, respectively, with an overall 66:34 ratio. Bull:heifer gender ratio for the two breeding seasons was 79:21 and 52:48 for SS and CS groups, respectively, with an overall 62:38 ratio. In conclusion, the fertility of SS insemination at 18 hr after onset of oestrus was 97% of CS insemination at 12 hr after onset of oestrus. Though breeding season pregnancy did not differ between SS and groups, preferred calf gender was 25 percentage points greater for SS over CS application. The gender accuracy was 88%.

5. Effects of Receiving Two Initial Feedings of Colostrum on the Average Daily Gain and Health of Pre-Weaning Group Housed Holstein Heifer Calves

Zheng QD, **Leal Yepes FA.**

DOI: 10.3390/ani11113209

Abstract: We studied the effect on average daily gain (ADG) and health of an additional colostrum feeding to Holstein dairy heifers 12-16 h after the first colostrum feeding, provided within 2 h of birth. Calves (n = 190) with an average birth weight of 38.8 kg (29.5-52.6 kg) were randomly enrolled in blocks to either the control (CON) or colostrum (COL). The CON received 3 L of acidified pasteurized whole milk, and the COL received 3 L of pasteurized colostrum [average: 25.5 (24.7-26.4)% Brix]. Calves were group-housed, weighed, withers height measured weekly. Serum was obtained and analyzed with a% Brix refractometer. Mixed linear models were used to assess the differences in ADG, body weight, and height between the treatment and control. There was no difference in ADG between the COL and CON. However, serum % Brix was higher in the COL group (9.7%) than in the CON group (9.2%). Calves in the COL had more antibiotic treatments for respiratory diseases but fewer antibiotic treatments for otitis than the CON. In conclusion, providing an extra feeding of colostrum did not contribute to ADG of Holstein heifers during the pre-weaning period but did provide them with a higher total serum protein concentration.

Continuing Education

Veterinarians

1. Lessons learned about Jersey and Holstein GI and respiratory disease. WSU Veterinary Medicine Extension. Twin Falls ID, February 9; Nampa ID, February 10. Contact Veterinary Medicine Extension coordinator Katy Heaton for more details: cowgirlup4ever@wsu.edu, (509) 335-8221.
2. WSU CVM Spring Veterinary Conference. March 25-27, 2022. The agenda will be posted at: https://cvme.vetmed.wsu.edu/cvme-events/2022/03/25/vetmed/spring-conference-2022

Producers

1. Farm Animal Risk Mitigation: Prepare, Prevent, Evaluate—animal health biosecurity plans and best management practices for your farm. 8-part webinar series. Tuesday evenings 5:30-6:30 PST January 4-March 1, 2022. Info: https://farmppe.netlify.app/ . Click HERE to Register.
2. 2022 Pacific Northwest Animal Nutrition Conference. January 17-18, 2022. Boise ID. Info can be found HERE. Click HERE to register. Registration deadline January 18.

GUESS THAT BREED!

The Answer will be posted on the VME Homepage, under Newsletters:
https://vetextension.wsu.edu/

Visit our website for information on current research projects and outreach materials for veterinarians and producers! http://vetextension.wsu.edu/

Send newsletter comments to the Editor: ***ag animal health***
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