Veterinary Medicine Extension
Washington State University

VETERINARY MEDICINE EXTENSION

AG ANIMAL *health*

College of Veterinary Medicine

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In This Issue

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From the Editor –An article about elk hoof disease has us thinking about the interface between humans and wildlife and wildlife and livestock… We just got through winter and now we are talking about heat stress? To get us prepared for the upcoming summer months, I will review an article on heat stress effects on pigs and Dr. McConnel will dive into heat stress and the dry cow. Dr. Adams-Progar reviews the use of technology with dairy cattle, and I found an article on feeding corn silage to baby calves. And, the ag animal faculty have been busy – See the research updates for the kind of work we've been doing.

ag animal health ***is devoted to the transfer of current, relevant information to food animal owners and veterinarians in the Pacific***

Congratulations, Dr. Tibary & Dr. Moore!

Dr. Ahmed Tibary

Dr. Ahmed Tibary received a very high honor from his specialty organization. From the Theriogenology Foundation, Society for Theriogenology and American College of Theriogenologists he is the 2019 recipient of the ***Bartlett Award***. This is amongst the highest awards that a theriogenologist can receive. Congratulations!

We would also like to congratulate our very own, Dr. Dale A. Moore, for receiving the ***Sahlin Faculty Excellence Award*** at the 2019 Academic Showcase. This award was given for her outstanding achievements in Outreach and Engagement – Congrats Dr. Moore!

Dr. Dale Moore

How ‘Bout Them Vet Students? Helping Out 4H Youth

by Dale A. Moore, Extension Veterinarian, WSU

On March 16th, four veterinary students helped out with the 4H Sheep and Goat Field Day in Asotin. They set up three stations to talk to kids and their parents about (1) How to do a physical exam on their sheep (2) What diseases the fair vet looks for and (3) Vaccinations and injection sites. These students talked many times to small groups. The 4H leaders and the kids were very grateful. Kudos to Kim Menke, Tom Phillips, Sidney Jones and Alisha Mason (L to R)!

Hoof Disease in Elk. Is There a Cause for Concern?

by Margaret Wild, DVM, PhD, Professor and Elk Hoof Disease Research Lead, WSU

If you’re from southwest Washington, you’re probably aware of the emergence of “hoof rot” in elk over the past decade. More recently, the disease has been detected in local elk herds across much of the western portion of the state, and east to the Blue Mountains. Our neighbors in Oregon and Idaho are also seeing cases.

So what do we really know about this disease that leaves elk lame with foot ulcers, deformed, overgrown, or sloughed hooves, and often diminished body condition and premature death? Progress has been made, but many questions remain. To help address this need, in 2017 the Washington Legislature unanimously passed a bill providing funding to the Washington State University, College of Veterinary Medicine (WSU, CVM) to tackle the issue.

The Washington Department of Fish and Wildlife (WDFW) began investigating the disease in 2008 when the number of limping elk reported in the Mount St. Helen’s and Willapa Hills areas increased markedly. The cause was unknown.

Several explanations for the disease were proposed, including a common belief among some of the public that the disease was linked to herbicides and fertilizers applied in commercial forestry. Working with various collaborators, the WDFW identified treponeme bacteria infecting the hooves, which gave rise to the technical name of the disease, treponeme-associated hoof disease (TAHD). Additional investigation supports that treponeme bacteria are involved in the infection; however, the role of other pathogens, as well as animal health and environmental factors, including herbicide exposure, that may predispose elk to disease, are yet to be fully investigated.

This group of spiral-shaped treponeme bacteria are familiar to cattlemen who have battled hairy heel warts, or bovine digital dermatitis. Digitial dermatitis is an important cause of lameness leading to significant economic loss and animal welfare issues, particularly in dairy cattle. Even with intensive management, the disease can be difficult to treat and reinfection is common. This leads to concern regarding the risk to cattle from infected elk. Similarly, the risk to elk from cattle with digital dermatitis must be considered. Currently it is too soon to know. Research hasn't yet been conducted to determine whether hoof disease can be transmitted between cattle and elk. To date, TAHD has not been diagnosed in other wildlife species, such as deer.

Research to learn more about elk hoof disease is underway at WSU. Since August 2018, a research team in the Department of Veterinary Microbiology and Pathology has begun addressing multiple aspects of the disease. Over the next several years, we will:

- Study disease cause(s) and contributing factors in captive elk. Use captive elk in a controlled environment to learn about the cause(s) of the disease and investigate contributing factors that make elk more or less susceptible to disease. Subsequent studies will investigate transmission between species.
- Study disease agents in the lab. Use sophisticated analyses to study the genetic material recovered from hoof lesions to identify bacteria or other pathogens associated with disease in general, and at specific points in the disease course.
- Conduct regional surveillance. Collect hoof samples from across Washington and other states in the northwest to determine where the disease occurs and whether or not the pathogens and risk factors involved are the same in every area.
- Understand social aspects of the disease. WSU is currently seeking participants to share their thoughts and perspectives about hoof disease and elk management to guide outreach and education efforts and contribute to setting goals for research and management. If you are interested in participating, contact Dr. Lauren Scott at lauren.n.scot@wsu.edu by April 1st.

Dairy: The Importance of Dry Cow Cooling

by Craig McConnel , Extension Veterinarian, WSU

Dr. Geoffrey Dahl of the University of Florida presented a lecture at the 2019 Pacific NW Animal Nutrition Conference entitled, "Top Eleven Considerations for Dry Cow Cooling." Much of the focus

was on the negative effects on productivity and health in the next lactation if dry cows are not kept cool. Heat stress during the dry period can lead to 8 to 10 lbs less milk each day during the subsequent lactation. This effect is a result of depressed mammary epithelial cell growth in heat stressed cows. Even if heat stress is limited to the first or second half of the dry period, there are negative effects on subsequent yields. Heat stressed dry cows limit feed intake and have lower bodyweights relative to cooled herdmates. Interestingly, despite the reduced intake there is no evidence that heat stressed dry cows experience particular metabolic impacts as compared to cooled cohorts. Nonetheless, heat stress reduces the immunologic response to vaccinations and has direct negative impacts on cows' ability to respond to pathogens.These negative consequences of heat stress carry over into the early lactation and can increase the risk of diseases such as metritis, mastitis, and pneumonia. Perhaps unsurprisingly given the multitude of deleterious effects, dry cow heat stress is also deemed a risk factor for reduced reproductive performance. All told, the negative impact of dry cow heat stress is substantial and economic estimates suggest that prevention of milk loss alone is enough to yield a positive return on any cooling system improvements.

The findings above may not come as a surprise to the majority of dairy producers, managers, and veterinarians, but certainly warrant making the time to reassess the far-off and close-up pens looking for areas that could be improved. What may be more startling is the effect of dry cow heat stress on the fetus and subsequent heifer calf. A recent article (Skibiel et al, 2018, Scientific Reports 8) demonstrated that intrauterine heat stress alters the offspring epigenome and programs their morphology in postnatal life, which may explain poorer performance of in utero heat stressed calves. Calves born to heat stressed dams weigh less at birth, weaning, and a year of age relative to calves born to cooled calves. The transfer of passive immunity is also compromised in calves that are heat stressed in utero. Their efficiency of immunoglobulin absorption within the gastrointestinal tract is reduced leading to lower concentrations of circulating IgG during the first months of life. In fact, in utero heat stressed calves are more likely to exit the herd due to illness, and fewer of those calves complete their first lactation relative to calves from cooled dams. The effects of in utero heat stress actually extend into the first lactation as well, with more services required to achieve pregnancy. Similar to their heat stressed dams, these heifers also produce approximately 10 lbs less milk each day during their first lactation as compared to heifers from cooled dams. Amazingly, it appears that calves that are heat stressed in utero remain less productive through their second and third lactations, and actually pass on their poorer performance to their offspring!

Assessments of heat stress should focus on the temperature-humidity index (THI). A THI of 68 will lead to increased rectal temperatures and respiratory rates in cows, suggesting that heat abatement should take place prior to reaching that level. Reducing the heat load on dry cows depends on the same methods used for lactating cows. Soakers or misters, fans, and shade can be used as effective heat abatement strategies. Keep in mind that shade alone may not suffice in times of both high heat and humidity. Sand-bedded stalls may provide relief through conductive heat transfer. Overcrowding should be avoided with recommendations to go no higher than 100% stocking density in dry cow pens. Whichever methods are implemented to limit the effects of heat stress, consider assessing the effectiveness of the system through frequent assessments of rectal temperatures or respiratory rates. Additional information regarding preparing for summer on the dairy and heat stress prevention can be found here.

Dairy: Using Technology to Monitor Animal Health

by Amber Adams Progar, Dairy Management Specialist, WSU Animal Science

Photograph of two Holstein heifers wearing activity collars

Do you know how many published scientific articles are related to wearable cow technologies and disease detection in dairy cattle? According to a recent review (Eckelkamp, 2019) the answer is 99 articles. This number resonates with me, given how this area of research is still rather fresh. Interest in using precision technologies on dairies has grown exponentially, especially over the last decade. Wearable cow technologies such as collars, ear tags, and leg bands are capable of recording cow behavior, location, and temperature. By identifying changes in behavior and temperature patterns, wearable technologies can detect heat in cattle and send an alert to the farmer, making heat detection look easy. Although most technologies initially focused on heat detection, disease detection is another added benefit to using most wearable devices.

The scientific literature has a wealth of published studies that investigated disease detection with wearable devices. The authors of one of these studies (Stangaferro et al., 2016) evaluated whether an activity monitoring collar could identify cows with metabolic diseases. They followed 1,080 Holstein cows from 21 days pre-calving to 80 days post-calving. Each cow was fitted with an activity collar and trained personnel conducted routine clinical examinations to diagnose diseases. Fifty-eight percent of the cows were diagnosed with at least one health disorder during the study, in which the collars correctly identified 93% of those cases. What surprises me the most is that the collars detected metabolic diseases in cows as much as 3 days earlier than a clinical diagnosis.

Another study (Schirmann et al., 2016) aimed to examine whether an activity monitoring collar could detect metritis or subclinical ketosis in cows, based on differences in rumination and feeding behavior. The researchers enrolled 64 multiparous Holstein cows into the study and fitted each cow with an activity collar. The behavior and health status for each cow was recorded from 10 days pre-calving to 3 weeks post-calving. During the pre-calving period, healthy cows spent 14% more time ruminating than cows with subclinical ketosis. Healthy cows also spent 18-29% more time feeding during the pre-calving period than cows with subclinical ketosis or a combination of subclinical ketosis and metritis. However, no differences in rumination time post-calving were detected. At 3-8 days post-calving, healthy cows spent 13-25% more time feeding than cows diagnosed with disease. Healthy cows also spent up to 24% more time feeding than cows with metritis or subclinical ketosis during the 9-14 days post-calving period. The authors of this study demonstrated how behavioral differences can be monitored to assist with disease diagnoses in dairy cattle. Activity collars and other forms of wearable devices have a high likelihood of improving disease detection on dairies.

Wearable technologies, however, require an investment, an investment that is more and more difficult for a farm to make when the dairy market falls. One of my mottos is that "if a farmer is going to invest hard-earned money into a technology, then he/she needs to get as much as possible from that technology". This is one reason why my research team decided to further investigate the capabilities of wearable cow technologies. If these devices can assist with heat detection and the detection of metabolic and transition cow diseases, can they also identify cows with hoof disorders? We focused on answering this very question.

Our research team currently uses CowManager® ear tags with our lactating cows and HerdInsights™ collars with our weaned heifers. One study we recently completed examined how activity monitoring ear tags could assist with the detection of digital dermatitis in cows. Over the course of two years, we fitted 219 Holstein cows with activity monitoring ear tags. We collected behavior data daily via the ear tags. On a monthly basis, we analyzed the back feet of all cows in the milking parlor. We recorded whether each cow had an active or digressing hoof lesion and noted any swollen feet. Two key findings developed from this study: 1) cows without a hoof lesion spent 72 minutes more eating each day than cows with a hoof lesion and 2) cows with active hoof lesions exhibited 42 minutes less of high activity each day than cows with digressing hoof lesions. This last finding is especially concerning for anyone that is trying to detect heat in a cow with an active hoof lesion.

Can wearable cow technologies improve heat detection? Yes. Can wearable cow technologies improve disease detection? Yes. As with any investment, though, dairy farmers need to decide whether the cost is worth the benefits. My research team and I will continue to push the limits of these technologies to help determine exactly what they can and cannot do. In the meantime, please share your experiences with wearable cow technologies. My email address is amber.adams-progar@wsu.edu.

References

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- Stangaferro et al. 2016. Use of rumination and activity monitoring for the identification of dairy cows with health disorders: Part I. Metabolic and digestive disorders. J. Dairy Sci. 99:7395-7410. https://doi.org/10.3168/jds.2016-10907

Dairy: Feeding Dairy Calves Corn Silage – Do We Need to Buy Calf Starter?

by Dale A. Moore, Extension Veterinarian, WSU

Most dairy farms make their own corn silage and if they have enough ground and raise enough corn silage, they could use some for heifers. Corn silage is commonly fed to growing heifers after weaning and to bred heifers, but what about feeding it to pre-weaned calves? A very recent study from Wisconsin, reported in the *Journal of Dairy Science,* investigated the use of this common feed in pre-weaned calf diets.

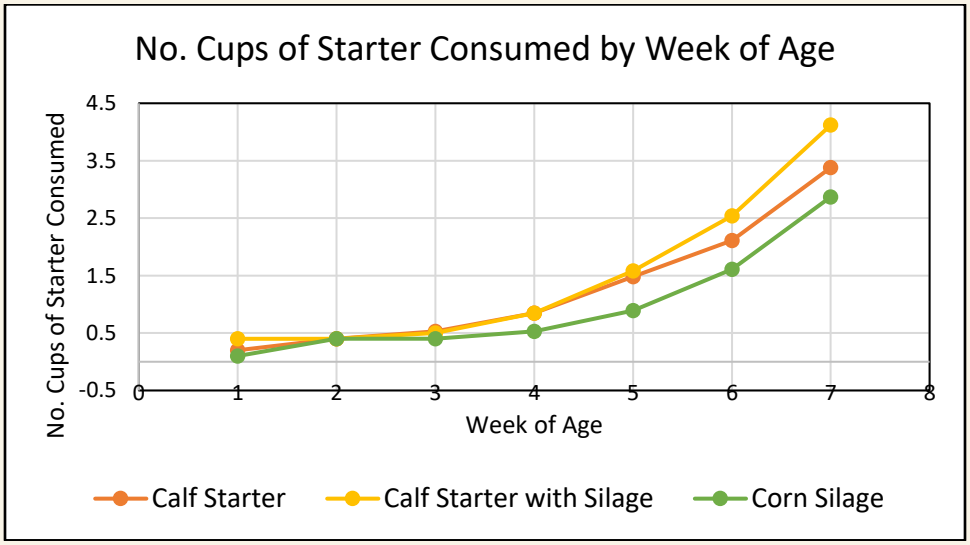
Forty-five calves, housed in individual, outdoor hutches, after receiving colostrum, were fed 6 quarts of pasteurized waste milk with a milk balancer for the first 5 days of life and then 8 quarts until 7 weeks old. Milk allotment was gradually reduced until weaning. The calves were assigned to one of three groups: calf starter only, a mix of 50% calf starter and 50% corn silage dry matter, or all corn silage based on dry matter. Feed intake was measured daily.

Calves were weighed and height measured at 2 days of age and at 2, 4 and 8 weeks. Blood was taken at day 2 for serum total protein evaluation. Blood samples were also taken for PCV, serum total protein, and BHB. Health was assessed daily. Nine of the calves were sacrificed at 8 weeks of age to look at the rumen papillae and villi and intestinal villi.

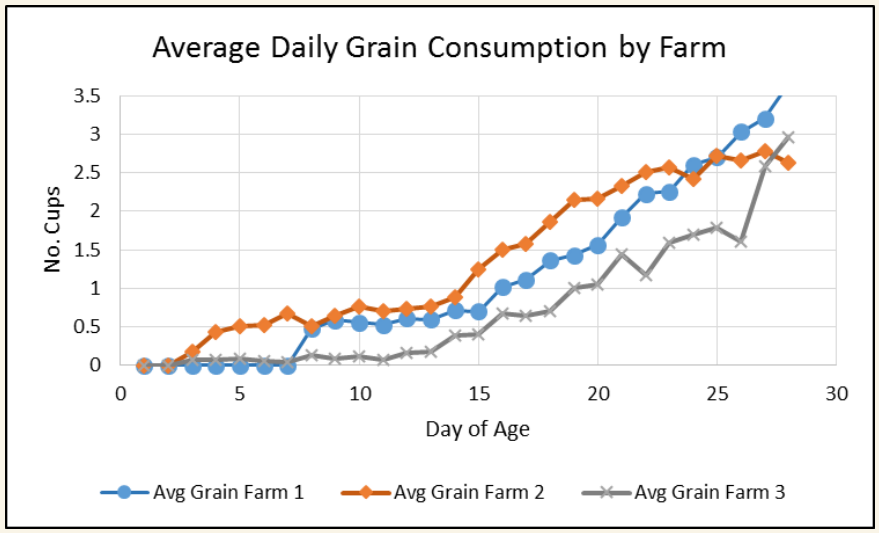
When evaluating Average Daily Gain (ADG), overall, there was no difference in the gains of calves across the 8 weeks. However, in week two, the starter/silage mix calves gained over a half pound more per day, on average. Body measurements, health scores and blood parameters were not different.

The most significant finding was the difference in rumen papillae length, width, and concentration. The all corn silage-fed calves had the smallest average papillae length and width compared to the other calves that got half calf starter. The papillae concentration was greater in the mix-fed calves compared to the calf starter fed calves.

Starter intake (as fed) over the entire treatment period of 7 weeks averaged 293 (about 1.2 cups), 348 (about 1.5 cups), and 245 (about 1 cup) g/d for the calf starter, mix and corn silage only groups, respectively (P = 0.19). In the figure below (cups of feed estimated from data presented in the paper) we can see the change in starter consumption over time. Although the average starter consumption was not different over all, it was different across time. The lines diverge after week four. By week seven, the calves getting the starter/silage mix were eating more, on average.



We need to compare these findings with calf starter consumption for limit milk-fed calves. In a study we presented in 2017, we had three farms that limited milk consumption to 4 quarts a day. Starter grain consumption was measured daily and we found that the farms were different but that calves were eating about 3 cups of starter grain per day by week four (figure below) compared to the 0.5 cups being consumed by the calves getting at least 8 quarts of milk a day. Although we did not take our study out to 7 weeks like the one above, we could assume that the calves with limited milk would be eating far more starter by 7 weeks than the about 3.5 cups in the study above.



There are a couple of take home messages for me. First, when I read the results of a study like this, I need to make sure that the way the study was done (how the calves were fed) is relevant to me or the operations with which I work. Second, feeding all corn silage to pre-weaned calves did not make a weaned animal completely ready to eat an all dry diet because they need the long rumen papillae to efficiently absorb the volatile fatty acids from the rumen when eating dry feed (as a ruminant). However, feeding some forage, like the 50% corn silage with the calf starter looks intriguing and does not appear to hinder intake, growth or health.

In a meta-analysis (a synthesis of data from a lot of research trials) reported in the Journal of Dairy Science in 2017, Imani and colleagues summarized that feeding forage increased post-weaning and overall starter intake by 0.442 and 0.176 lb/d, respectively, and had a benefit on ADG and final body weight. Some of the increase in ADG is likely due to gut fill. The improvement in starter feed intake and final body weight was most evident for calves offered free-choice forage, not as a TMR, but depends on the inclusion rate (maybe less than 10%?) and forage source.

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Beef: Timing of Weaning on Post-Weaning Performance of Beef Calves

by Dale A. Moore, Extension Veterinarian, WSU

After calving, the beef cow has to replenish or maintain herself, get ready for the next breeding season as well as provide milk for her calf. Providing milk for her calf also increases her maintenance energy requirements. Because cattle owners want to get cows bred back on time, some have looked into early weaning strategies.

A recent article in the Journal of Animal Science highlights a study done with first calf heifers on drylots with early weaning. They hypothesized that because these heifers were still growing and have higher maintenance requirements while feeding a calf, removing the additional energy required for maintenance through early weaning "should improve feed efficiency and feed energy utilization."

Ninety Angus and AngusXHereford first calf heifers were enrolled. They were assigned to early weaning (about 130 days after calving) or traditional weaning (about 226 days). The early weaned cows were given 66% of the feed provided to cows with calves still suckling to just meet their requirements. The body weights of the cows were not different after 56 or 96 days into the experiment. The tissue retained energy for the early weaning cows was greater but the maintenance energy differences were not very different (about 3Kcal NEM lower for early weaning cows). Although not statistically different (P=0.18) there was a numerical difference in AI pregnancy rate (69% for traditional weaning cows and 82% for early weaning cows).
Calf performance was also evaluated. All calves were offered a nutrient dense diet. Although voluntary feed intake was greater for early weaned calves, the sum of feed and milk energy intake for traditionally weaned calves was 36% greater than early weaned calves, resulting in greater pre-weaning ADG and total body weight gain. These results could vary depending on the feed availability to the cows and calves. Other published work suggests that early weaned calves "offered a nutrient-dense concentrate diet generally gain faster compared with calves nursing dams and grazing moderate and possibly declining quality forage."

The early weaned calves were lighter going into the grazing period (day 96 to 218) but experienced some compensatory gain. Overall body weight was greater for traditionally weaned calves as they entered the feedlot but there was no difference in ADG in the feedlot. There were no carcass differences at slaughter, likely because these are more dependent on post-weaning management.

This study indicates that the traditional weaning system was more biologically efficient through weaning because of the only slight difference in maintenance energy requirements between the two groups. Although the authors took the calves of these cows all the way to harvest, we do not have an economic analysis of these strategies for the cow-calf side. *And, although not statistically different, the difference in AI pregnancy rate could be biologically important, in (my) this author's opinion, and should be examined further in other research. For conception or pregnancy rate studies, we often need more animals in the study groups. We could have seen a statistical difference if we had 184 cows in each group.*

So, the jury is still out on whether cow-calf herds should practice early weaning strategies because it depends on the feed available to both cows and calves, the difference in pregnancy rates a ranch considers significant, and the overall economics of any weaning strategy.

Reference

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Swine: In-utero Heat Stress Effects on Baby Pigs

by Dale A. Moore, Extension Veterinarian, WSU

Heat stress affects us all. But did you know it can affect the unborn as well? In a review paper in the *Journal of Animal Science*, Johnson and Baumgard (2019) evaluated all the literature on the consequences to the baby pig from being under heat stress in utero.

Pre-natal heat stress has a number of potential consequences on the piglets. First, there may be growth restriction while gestating under heat stress resulting in lower birthweights. This growth restriction could affect the piglets' development and might have long-term effects on their growth as a pig.

Pigs undergoing pre-natal heat stress increase their body temperature setpoint which could make them more vulnerable to heat stress after birth because of a loss of heat loss efficiency. A higher core body temperature could result in higher maintenance energy costs, thus reducing future feed efficiency or growth/weight gain.

One study provided evidence that pre-natal heat stressed pigs repartition their nutrients towards fat deposition rather than protein deposition but these effects may depend on when during gestation the heat stress occurred. If occurring during the first half of gestation, the pigs will have greater fat deposition.

The pre-natal heat stressed pigs may also have compromised *their* future offspring. The number of piglets that they produce (for gilts) is less. Boars that had been exposed to pre-natal heat stress can have a reduction in sperm production, increased sperm abnormalities, and decreased testicular size.

If the sow has undergone stress (due to heat or some other stressor), with an increase in maternal stress hormones, the stress can affect brain development in the piglets, affecting their future behavior. The pigs may have a post-natal altered stress response and an inability to cope with novel stressors later in life. Also, a number of fetal malformations or birth defects have been observed due to pre-natal heat stress such a short limbs and small brains.

Heat stress affects both the sow and her offspring, potentially resulting in poor piglet performance and carcass traits. To reduce the likelihood of heat stress requires an investment in cooling

technologies and management. Water, shade, ventilation, feeder during cooler times and reducing handling are some ways to minimize heat stress in pigs and all the potential consequences.

Johnson JS, Baumgard LH. Postnatal consequences of in utero heat stress in pigs. Journal of Animal Science. 2019;97:962-971.

Swine: African Swine Fever: Still in the News

by Dale A. Moore, Extension Veterinarian, WSU

In the last issue of *ag animal health*, I talked about African Swine Fever (ASF), but guess what? It is still in the news. In early March, USDA-trained sniffer dogs worked to help find about **1 million pounds of pork** smuggled into the US from China. China has an on-going ASF outbreak and that illegal meat poses a risk to US swine herds. To help people learn more about this disease, as well as the steps that can be taken to help protect U.S. pigs, the USDA's Animal and Plant Health Inspection Service has updated its website with new information and links to resources. This information is available at www.aphis.usda.gov/animalhealth/swine/asf

Additionally, USDA released four infographics on the following topics:
African Swine Fever Risk Pathways (PDF, 2.4 MB)
Biosecurity (PDF, 312 KB)
Signs and Symptoms of African Swine Fever (PDF, 209 KB)
Traveler Tips (PDF, 389 KB)

Sheep and Goats: Scrapie Update for the US

by Dale A. Moore, Extension Veterinarian, WSU

The new program standards for the National Scrapie Eradication program go into effect this month. The full report and all the details can be found at: USDA Sheep and Goat Health.

The most important NEW rules are for goats: "The slaughter and low-risk commercial goat exemptions have been eliminated. This means official Individual ID (official eartag, registry or flock ID tattoo, or official Electronic Implantable ID) is required for goats in interstate commerce moving for purposes other than slaughter or feeding for slaughter. Official eartags, rather than other forms of official ID, are required for goats in slaughter channels that are 18 months of age or older." "A record must be made when official ID is applied to a goat or a goat is acquired or disposed. The record must be kept for five years after the animal dies or is no longer owned by you." For details, see:
https://www.aphis.usda.gov/animal_health/animal_diseases/scrapie/downloads/goat-flyer-email.pdf

For sheep: "Group/Lot ID and Owner/Hauler Statement are required for: Sheep and goats in slaughter channels (except wethers under 18 months of age); Sheep and goats not in slaughter channels that do not have an official eartag or other official ID (except wethers under 18 months of age). Other changes include: If you engage in interstate commerce: (WHICH MEANS if you move sheep or goats interstate or offer to sell them to out of state buyers including through a market, or buy sheep or goats that originated in another state); you need to: officially identify sheep and goats that you later sell (if they are a class that requires official ID) prior to moving them; or take your official tags and have them applied at another site in-state before changing ownership; or take your sheep and goats to a federally approved market to be tagged with market tags." "A record must be made when official ID is applied to a sheep or goat, or a sheep or goat is acquired or disposed. The record must be kept for five years after the animal dies or is no longer owned by you." For more details, see: https://www.aphis.usda.gov/animal_health/animal_diseases/scrapie/downloads/sheep-flyer-email.pdf

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WSU Ag Animal Faculty Research Updates

(1) McConnel CS, Nelson DD, Burbick CR, Buhrig SM, Wilson EA, Klatt CT, Moore DA. Clarifying dairy calf mortality phenotypes through postmortem analysis. Journal of Dairy Science. 2019; doi: 10.3168/jds.2018-15527. [Epub ahead of print].

Health problems can be thought of as phenotypic expressions of the complex relationships between genes, environments, and phenomes as a whole. Detailed evaluations of phenotypic expressions of illness are required to characterize important biological outcomes. **We hypothesized that classifying dairy calf mortality phenotypes via a systematic postmortem analysis would identify different cause-of-death diagnoses than those derived from treatments alone.** This cross-sectional study was carried out on a dairy calf ranch in the northwestern United States from June to September 2017 and focused on calves ≤90 d of age. Comparisons were made between causes of death based on 3 levels of information: on-farm treatment records alone, necropsy-based postmortem analyses in addition to treatment records, and Washington Animal Disease Diagnostic Laboratory (WADDL) results in addition to all other information. A total of 210 dairy calves were necropsied during this study, of which 122 cases were submitted to WADDL. Necropsy- and WADDL-derived mortality phenotypes were in almost perfect agreement (Cohen's $\kappa = 0.86$) when broadly categorized as diarrhea, respiratory, diarrhea and respiratory combined, or other causes. The level of agreement between on-farm treatment records and postmortem-derived results was low and varied by the level of diagnostic detail provided. There was just fair agreement ($\kappa = 0.22$) between treatment-based and necropsy-based phenotypes without WADDL input and only slight agreement ($\kappa = 0.13$) between treatment-based and corresponding necropsy-based phenotypes with WADDL input. Even for those cases in which causes of death aligned along a comparable pathologic spectrum, the lack of detail inherent to standard treatment-based causes of death failed to identify meaningful target areas for intervention. This was especially apparent for numerous cases of necrotizing enteritis and typhlitis (cecal inflammation) that were variously categorized as diarrhea and pneumonia by treatment-based diagnoses. The specificity of these lesions stood in stark contrast to the otherwise generic cause of death diagnoses derived from treatments.

The findings from this study supported the hypothesis and highlighted the value of on-farm necropsies and laboratory-based diagnostics to detect antemortem disease misclassifications, provide detail regarding disease processes and mortality phenotypes, and direct disease mitigation strategies.

(2) Sischo WM, Moore DA, Pereira R, Warnick L, Moore DL, Vanegas J, Kurtz S, Heaton K, Kinder D, Siler J, Davis MA. Calf care personnel on dairy farms and their educational opportunities. Journal Dairy Science. 2019;102(4):3501-3511.

As dairy herd sizes become larger and the organization of the business more complex, targeting communication and education to enhance animal care becomes more difficult. The purpose of this study was to describe selected demographics of calf care employees on large (>500 animals) and small (<501 animals) dairy farms that raise their own calves. Two to 8 individuals per farm involved with calf care, including owners, veterinarians, and calf managers, feeders, and treaters, were interviewed in either English or Spanish. Interviews were conducted in person on 53 dairy farms located in Arizona, Idaho, New York, Oregon, and Washington State. The number of preweaned calves on the farm ranged from 9 to 1,500 (median = 93). A total of 224 individuals were interviewed across 8 job titles. As farm size increased, personnel structure became more complex. Farms with >100 preweaned calves were 15 times more likely to have a calf manager title compared with farms with ≤100 preweaned calves. Eight farms designated the same person as calf manager, treater, and feeder, all with ≤100 preweaned calves. Thirty-two (60%) of the farms had at least 1 full-time calf feeder. Almost 30% of owners and over 40% of veterinarians interviewed were over 50 yr of age, whereas over 40% of the calf managers, feeders, and treaters were under 30 yr of age. Seventy-three percent of feeders and 72% of treaters spoke Spanish at home. For languages in which interviewees were comfortable speaking, more than 30% of owners and 33% of veterinarians were comfortable communicating in Spanish. For calf care employees, 60% of calf managers, 42% of feeders, and 38% of treaters were bilingual (English and Spanish), but most (72%) preferred to be interviewed in Spanish. The level of education varied by job title for those interviewed, but most of the calf care team had high school or less education. However, some diversity was observed in educational background within job title with almost 38% of the calf managers having at least some college education. The majority of feeders (88%) and treaters (83%) reported being trained by another employee and 66 and 58%, respectively, had not received any continuing education in the previous year. **With the amount of diversity seen on these farms, understanding employees' educational backgrounds, language, and generational differences may be valuable when developing training for new procedures for animal health or other aspects of animal care.**

(3) Pires AFA, Peterson A, Baron J, Adams R, Martinez-Lopez B, Moore D. Small-scale livestock and backyard owners survey, animal health and care needs in western states, United States. PlosONE. 2019;14(2):e0212372. https://doi.org/10.1371/journal.pone.0212372

The number of small-scale and backyard livestock and poultry owners in urban and peri-urban areas has increased greatly over the last 10 years in the U.S. However, these animal owners may live in areas without access to livestock and/or poultry veterinary care. **The purpose of this study was to identify potential veterinary service needs of these animal owners in the western US, assess their use of management and husbandry practices with regards to disease prevention, and assess their attitudes about animal health and food safety.** A semi-structured survey was made available to small-scale and backyard livestock and poultry owners in Washington State, California, Colorado and Oregon. The survey instrument included questions about types of animals reared, uses of the animals, veterinary services and information-seeking behaviors of owners, attitudes on animal health and food safety, and management practices. Four hundred thirty-five individuals

completed at least some portion of the survey. Most described themselves as living in rural areas (76%). Most (86%) owned chickens, 53% owned small ruminants, and 31% owned cattle. Many individuals owned more than one species and most had fewer than 20 animals of a given species. About 74% of respondents utilized their animals' products for their own consumption but 48% sold animal products (primarily through internet sales (35%) or farmers' markets (25%)). Overwhelmingly, respondents gained information about animal health (82%) and animal treatment procedures (71%) from the internet. Respondents reported their veterinarian's practice type as companion animal (26%) or a mixed animal or food animal predominant (66%). Overall, respondents were very satisfied with the level of care (82%), but 43% had not sought animal health care in last 12 months. However, the veterinarian's primary practice type and owner's satisfaction with veterinary care were associated with their location (state), species owned, and urban or peri-urban setting. Livestock species type (cattle, small ruminants and swine), and use (personal or commercial) were associated with implementation of different biosecurity practices. **The results of this survey highlight some of the needs of these animal owners for veterinary care and information which are location- and species-specific. Veterinary care for these small-scale and backyard animals is vital to the health and welfare of the animals as well as for identification of zoonoses and assurance of the food safety of animal products.**

(4) Kasimanickam RK, Kasimanickam VR, Arangasamy A, Kastelic JP. Sperm and seminal plasma proteomics of high- versus low-fertility Holstein bulls. Theriogenology. 2019;126:41-48.

Sperm are highly specialized compartmentalized cells, with unique compositional, morphological and functional properties, including a plasma membrane that undergoes dynamic protein remodeling and surface modifications. Seminal plasma is a highly complex biological fluid containing proteins, amino acids, enzymes, fructose and other carbohydrates, lipids, major minerals and trace elements. Seminal plasma proteins are involved in regulation of osmotic pressure and pH of seminal plasma, transport of ions, lipid and hormones. **The objective was to compare sperm and seminal plasma proteomes of bulls with differing fertility and to relate differences to biological processes.** Semen was collected from bulls with high or low fertility (4 bulls in each category). Sperm and seminal plasma proteins were isolated, purified, subjected to 2-D gel electrophoresis, protein identification and ontology. In sperm and seminal plasma, binder of sperm proteins (BSP)-1, -3 and -5, and spermadhesin-1, ALB, TIMP, AKI and PEBP1 were higher for high-versus low-fertility bulls ($P < 0.05$), whereas proteins CLU, CCT5 and 8, ELSPbP1, and PSMA6 were more abundant in sperm and seminal plasma of low- versus high-fertility bulls ($P < 0.05$). Further, HSP90, ZFP34, IFNRF4, BCL62, NADHD, TUBB3 and Histone H1 were in greater abundance in sperm of high- compared with low-fertility bulls. The two key biological processes of proteins differentially expressed in high- and low-fertility bulls were metabolic processes and biological regulation. The most prominent molecular functions for proteins that differed are binding, catalytic and receptor activities. The main cellular components for proteins that differed are cellular, extracellular, and plasma membrane. Since protein content differed in high- versus low-fertility bulls, we inferred that the efficiency of associated sperm functions that are necessary for fertility may also differ between high- and low-fertility semen. **In conclusion, differences between high- and low-fertility bulls regarding abundance of sperm and seminal plasma proteins likely contributed to differences in fertility.**

(5) Kiser JK, Cornmesser MA, Gavin K, Hoffman A, Moore DA, Neibergs HL. Rapid Communication: Genome-wide association analyses identify loci associated with colostrum production in Jersey cattle. Journal of Animal Science. 2019;97(3):1117–1123.

Consumption of an adequate volume of high-quality colostrum soon after birth is critical for a calf's health. Few studies have focused on the genetics associated with colostrum production, even

though several dairy herds in the United States have reported incidents of low to no colostrum production during the fall and winter seasons. **The objectives of this study were to identify loci associated with quantity and quality of colostrum production in a herd of Jersey cattle (n = 345) and to identify potential positional candidate genes and/or transcription factor binding site motifs located near associated loci.** Cattle that freshened between the months of October and December of 2016 at a single dairy were enrolled in the study and produced on average 3.03 kg of colostrum at their first milking. This study included 112 cattle genotyped with the GeneSeek GGP50k BeadChip and another 233 cattle previously genotyped with various other arrays. The 233 cattle genotyped at lower densities were imputed to the GGP50k BeadChip density using BEAGLE 4.1.1, and 2 genome-wide association analyses (GWAA) were conducted using an additive efficient mixed-model association expedited method with a genomic relationship matrix (EMMAX-GRM). The first GWAA investigated loci associated with colostrum quantity and identified 7 loci: 6 that were moderately associated ($5 \times 10^{-07} > P < 1 \times 10^{-05}$) and 1 that was strongly associated ($P < 5 \times 10^{-07}$). The second GWAA investigated colostrum quality and identified 1 moderately ($5 \times 10^{-07} > P < 1 \times 10^{-05}$) associated locus. Five loci harbored positional candidate genes which had functional relevance to colostrum production, and 1 locus located on BTA10 contained a transcription factor binding site motif for TFAP2A which has previously been linked to mammary gland development. Pseudoheritability estimates were moderate for colostrum quality (0.19 ± 0.06) and high for colostrum quantity (0.76 ± 0.11), suggesting that genomic selection for these traits would be possible. Diminished colostrum quantity or quality can have a significant impact on herd health and herd economics. **The identification of loci, positional candidate genes, and transcription factor binding site motifs associated with colostrum production could be used in genomic selection to allow producers to select for cattle with good colostrum production, improving calf health, and reducing economic losses to the herd.**

(6) Besser TE, Levy J, Ackerman M, Nelson D, Manlove K, Potter KA, Busboom J, Benson M. A pilot study of the effects of Mycoplasma ovipneumoniae exposure on domestic lamb growth and performance. PLoS One 2019 Feb 7;14(2):e0207420. doi: 10.1371/journal.pone.0207420

Mycoplasma ovipneumoniae is a globally distributed pathogen that has been associated with pneumonia in both domestic and wild Caprinae. It is closely related to M. hyopneumoniae, a respiratory pathogen of swine that is associated with decreased growth rates of pigs as well as clinical respiratory disease. In order to assess the effects of M. ovipneumoniae on lamb performance, we generated a cohort of lambs free of M. ovipneumoniae by segregation of test negative ewes after lambing, then compared the growth and carcass quality traits of M. ovipneumoniae-free and -colonized lambs from weaning to harvest. Some signs of respiratory disease were observed during the feeding trial in both lamb groups, but the M. ovipneumoniae-exposed group included more affected lambs and higher average disease scores. At harvest, lungs of lambs in both groups showed few grossly visible lesions, although the M. ovipneumoniae-exposed group did exhibit increased microscopic lung lesions ($P<0.05$). In addition, **M. ovipneumoniae exposed lambs produced lower average daily gains ($P<0.05$), and lower yield grade carcasses ($P<0.05$) compared to those of non-exposed lambs. The results demonstrated the feasibility of test and segregation for elimination of M. ovipneumoniae from groups of sheep and suggested that this pathogen may impair lamb growth and productivity even in the absence of overt respiratory disease.**

Continuing Education

Veterinarians

Academy of Dairy Veterinary Consultants. Spring meeting. April 5-6, 2019. Las Vegas, NV. https://academyofdairyveterinaryconsultants.org/

WSU CVM Homecoming CE Event, October 16, 2019. WSU Pullman. 9 AM to Noon, 3 hours of FREE continuing education for large and small animal practitioners and technicians. For other CE programs visit: http://cvme.vetmed.wsu.edu/

WSU CVM Spring Conference, March 27-29, 2020. SAVE THE DATE! Pullman, WA. For updates visit: https://cvme.vetmed.wsu.edu/

Producers

Washington State Beginning Shearing School; April 2 to 6, 2019, in Moses Lake, Wash. An Advanced Shearing School is April 7, 2019, also in Moses Lake. For information, contact Sarah Smith at 509-754-2011, ext. 4313, smithsm@wsu.edu, or visit www.wssp.org

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

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