

USAHA COMMITTEE ON SHEEP, GOATS, AND CAMELIDS

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The Committee met on October 15, 2020, virtually, from 2:30-4:30 p.m. EST. There were 125 members and guests present. Chairman Hendrickson gave a quick review of the agenda and explained that no resolutions had been submitted. Furthermore, she stated that discussion on the survey sent asking for feedback on USDA responses to last year would be held during the very short business session.

Report of the Subcommittee on Scrapie and Identification

Cheryl Miller presented the report of the Subcommittee on Scrapie and Identification. The report, in its entirety, is included at the end of this report.

Food Animal Residue Avoidance and Depletion (FARAD) Program: Updates and New Initiatives

Lisa Tell, University of California, Davis

An update was provided on the FARAD program and some of the new initiatives within the program. FARAD was established in 1982 and is a university-based national program that serves as a primary source for providing veterinarians with scientifically based withdrawal recommendations following extra label drug use in food animals. This ensures that drug residues are not present in the food supply and that products are safe for human consumption. The primary task for FARAD is to provide a no fee service and answer questions submitted by veterinarians regarding on-label and extra-label drug use in food animals. In cases of extra-label drug use, FARAD provides withdrawal interval recommendations for both major and minor food animal species when there is enough scientific data. In addition, FARAD provides withdrawal interval recommendations for contamination cases such as feed mill errors or accidental exposures to drugs or pesticides.

One of the initiatives that FARAD has been focusing on is development of physiologically based pharmacokinetic models that will allow responders to estimate withdrawal intervals for high priority medications and species. In addition, the program is working on the development of an updatable list of rapid assays that can be used for food animals. This feature will include the test name, active ingredient, species, matrix, and sensitivity of the test.

FARAD also disseminates information through various outreach platforms with the goal of providing information on topics that are of high interest, new regulations, or medications for which a lot of questions are received. In addition, FARAD continues to publish Digests in the Journal of the American Veterinary Medical Association. The FARAD website, <http://www.farad.org/>, provides links to the various educational resources that are available.

NAHMS Update and 2019 Goat Study

Natalie Urie, USDA, Animal and Plant Health Inspection Service (APHIS), Veterinary Services (VS), Strategy and Policy (S&P), Center for Epidemiology and Animal Health (CEAH), National Animal Health Monitoring System (NAHMS)

NAHMS conducts national studies that provide essential information on livestock and poultry health and management to decision makers, including producers, researchers, and policymakers. National estimates generated from a NAHMS study are used to provide up-to-date and trend information needed to monitor animal health, support trade decisions, assess research and product development needs, answer questions for consumers, and set policy. To be successful, producer participation must be voluntary, and data from individual operations must be kept confidential. This ensures the collection of high-quality data. NAHMS partners with USDA's National Agricultural Statistics Service (NASS) to ensure that potential study participants are selected from a statistically representative sample of producers.

Before a NAHMS study begins, a needs assessment is conducted years in advance. This is accomplished through networking with industry, producers, academia, and other individuals within USDA Veterinary Services (VS). A study is then designed and includes sample allocation, questionnaire development, biologic incentives, training, and development of all materials. Data collection is completed in two phases. At first, there is contact by a NASS representative to obtain informed consent and then someone from the VS field force will follow up with a questionnaire and gather any needed biologics. Data analysis is completed by NAHMS and includes validation of all data, weighting, and estimation, and then double checking the numbers and analyzing results. Results are then reported in various forms and disseminated to a broad audience.

2019 Goat Study

Of all eligible operations, sixty percent completed the General Goat Management Questionnaire (n=1,840). Of those, 60.5% completed the VS questionnaire.

Findings- Highlights

- Regardless of operation size or region, the primary use for goats was meat; 63.5 percent of all operations had at least one goat to produce meat. Milk production was a primary use for at least one goat on 26.1 percent of all operations. Only 2.7 percent of all operations kept any goats with a primary use as angora/fiber. Any goats as pets/companions were a primary use on 11.6 percent of operations. A higher percentage of small and medium operations (15.5 percent and 9.3 percent) reported any goats with a primary use as pets/companions compared to large operations (1.1 percent).
- There was no predominant single breed for meat or dairy goats. Boer and Spanish goats represented 68.5 percent of the total meat goat inventory. On dairy operations, Crossbred/experimental, Alpine, Saanen, and Nubian represented 27.5, 19.7, 17.8, and 13.8 percent of the goat inventory, respectively. Over one-half of goats on operations with a primary production type of other were and Boer, which were likely used for angora fiber production and show/seed stock, respectively.
- Of the operations that bred any goats, about three-fifths had a defined breeding season. A higher percentage of large operations had a defined breeding season than small operations. There were no differences by region in the percentage of operations that had a defined breeding season.
- A higher percentage of producers on large operations than on small operations consulted a veterinarian. A higher percentage of dairy producers than meat or other producers consulted a veterinarian.
- For operations that added adult or kid goats in the past year, the majority (85.0 percent) required inspections or treatments either prior to arrival on the operation or after arrival but before commingling with other goats and 55.9 percent required inspections and treatments both prior to arrival on the operation and prior to commingling with other goats. The procedures required by the highest percentage of operations prior to or after arrival and before commingling goats were any vaccinations, internal parasite treatment and inspecting goats for abscesses and/or scars from previous abscesses.

State of the Sheep Industry & Update on the Secure Sheep & Wool Supply Plan

Erica Sanko, American Sheep Industry Association

An update was provided on the impact of the COVID-19 Pandemic on the sheep industry. Like other industries, the sheep industry was not immune to the COVID-19 pandemic, and it was a challenging

period with a lot of uncertainty. Initial impact came at the industry's peak market and perhaps weighed more heavily on the lamb industry as it is more dependent on the foodservice sector than other proteins. Nonetheless the Lamb industry was able to weather the impacts better than other livestock & poultry sectors in terms of supply management.

Today, the lamb processing sector looks much different today than pre COVID-19. The second largest processing plant was forced into sale and was purchased by a cattle processor to further process beef. However, there is some renewed optimism in the industry with a new carcass processing plant coming online in mid-September and the purchase of an old lamb processing and fabricating plant in Texas, which is expected to be processing and fabricating by end of the year. Lamb was not the only sheep product impacted. Wool, which was already struggling due to the China trade issues, has also been impacted by COVID-19 pandemic. The U.S. exports more than half of American wool to China, our largest market by far. China is also the largest export destination for sheep skins. Today, demand for sheepskins and beef hides/leather is down dramatically with much of the world's production going to landfills or rendered.

In addition, an update was given on the completion of the industry's business continuity plan. The Secure Sheep and Wool Supply (SSWS) plan provides protocols and procedures that may allow the sheep and wool industries to maintain some critical aspects of business or enable a quicker return to business during an animal disease outbreak response. With 65 pages of content that address topics such as inventory and movements, financial planning, enhanced biosecurity, communications, sheep health and managing inputs and outputs, as well as unique considerations such as wool handling and grazing public land allotments, the plan lays out factors to consider regarding surveillance, biosecurity movement permitting of sheep in a foot and mouth disease (FMD) outbreak with an eye toward the unique aspects of sheep, FMD infection in sheep and typical sheep husbandry practices. Lastly, a review of the resources available with the plan, the website and expected next steps for the plan, was provided.

Transitioning to Electronic Identification (EID) – Can we do it and by when...

Cindy Wolf, University of Minnesota

Current mandatory ID requirements for sheep industry have been in place since 2001. The primary focus of identification requirements has been on breeding stock movement. The availability of no cost visual tags has been key to enhancing compliance. Recently ASI formed an Electronic ID Transition Working Group in anticipation of an expected USDA move to electronic ID as an official form of identification.

Charge of the Working group is to develop a blueprint for the sheep and goat industries to transition from mandatory visual identification to electronic identification were deemed appropriate for animal disease traceability, including but not limited to scrapie eradication. Working group has had virtual meetings occur twice a month since May and during this time, meetings have included presentations of sheep and goat EID programs in other parts of the world, details regarding EID device options plus options for readers and in-depth discussion of the multitude of challenges regarding implementation in commerce. The Working group consists of 18 members with good representation from all aspects of the sheep industry, tag manufacturers, goat industry, extension and American Sheep Industry (ASI) leadership. In addition, there are subject matter experts from state and local government invited to participate when possible.

Two subgroups have been identified. The first has studied the current use of EID technology in the Sheep/Goat industries. Currently, uses of EID can be found in integrated flock/herd management systems, carcass trait evaluation of market lambs from fairs, in dairy goat herd management, including active use of EID implants in goats (base of ear, ventral aspect of distal half of tail). However, none of these uses can be found on an industry-wide scale.

Some of the current challenges include adoption on industry-wide scale by all stakeholders are significant pushback by auction markets and operations with extensively raised goats, (i.e., not-easy to handle or to apply ID), available software, costs relative to benefits (i.e., slaughter bound lambs and kids) and value of the animal, (i.e., low dollar value of cull ewe), adaptability and cost of EID to all different sized operations, and record-keeping.

The second subgroup will begin discussions in early November and will examine gaps in EID usage and identify what is not in place to transition to EID for everyday sheep and goat movements.

Sheep and goats share some of the same challenges that the cattle industry faces. Working together will be helpful. The common theme is the need for ongoing education.

Update on Current Status of Sheep and Goats in Alaska

Maggie Highland, Kansas State University

***M. ovipneumoniae* facts**

- Opportunistic pulmonary pathogen of *Caprinae* subfamily members (sheep, goats, muskox)
- First identified in sheep in Australia (1972)
- Sheep and goats considered the “natural” hosts
- Nasal carriage (“shedding”) allows for antemortem testing
- Recently identified in: *Capreolinae* subfamily members (white-tailed deer, mule deer, caribou, moose), bison, antelope (Qatar), cattle (Colorado, Kansas)
- Never been identified/reported in camelids
- Identified as a bacterial agent (highly) associated with respiratory disease in bighorn sheep
 - Western North America (as far north as southern Canada)
- Never been reported in association with pneumonia outbreaks in Alaska wildlife species
 - Prior to 2017 – some suggested *M. ovipneumoniae* must not be in Alaska
 - To date, identified in caribou, mountain goats, Dall sheep, moose, domestic sheep, domestic goats

Places to find information on *Mycoplasma ovipneumoniae* (in Alaska and in general)

- Alaska Department of Fish and Game
<https://www.adfg.alaska.gov/index.cfm?adfg=hottopics.movi>
- Alaska Division of Environmental Conservation – Office of the State Veterinarian (Dr. Bob Gerlach) <http://dec.alaska.gov/eh/vet/movi/>
(Under “Resources and Links”: *Domestic/Wildlife Interactions: Mycoplasma ovipneumoniae in Alaska* – Summarizes latest data from both ADF&G and ADEC-OSV)
- USDA-APHIS (posted/updated 9/25/2020)
https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/sa_animal_disease_information/sheep-goat/movi/mycoplasma-ovipneumoniae

Proposed Alaska Regulation for *M. ovipneumoniae*

- Beginning in 2016 proposals to regulate domestic sheep and goats in Alaska – primarily pushed by the Alaska Chapter of the Wild Sheep Foundation (not a state/regulatory agency)
 - 2016 (Proposition 90) and 2017 (Proposition 64)
 - Remove sheep and goats from the “clean list”
 - Fencing requirements w/in 15 miles of Dall sheep habitat
 - None passed to date
- New/current proposed regulations by DEC-OSV [18 AAC 36] – Regulations that were directed by a request from the governor’s office
 - Proposal includes adding *M. ovipneumoniae* testing requirement to importing sheep and goats
 - Information regarding these proposed regulations can be found at: <http://dec.alaska.gov/eh/vet/regulations/animal-health>
 - Copy of the proposed regulations: <https://aws.state.ak.us/OnlinePublicNotices/Notices/View.aspx?id=199102>
 - Open public comment period: August 7, 2020 through October 30, 2020
<http://alaskadec.commentinput.com/?id=crx28>
 - FAQ site: <http://dec.alaska.gov/eh/vet/regulations/animal-health/faq/>
Regarding the FAQ site, one thing to point out for the answer to the following FAQ:
Question: Why require *Mycoplasma ovipneumoniae* testing of sheep and goats older than 2 months of age?
Answer: “Testing at 2 months and older is based on recommendations from Washington Disease Diagnostic Laboratory at Washington State University. Lambs and kids typically remain uninfected with *Mycoplasma ovipneumoniae* for a considerable time after birth. Data shows this is typically about 2 months, although in some herds can be 6 months or longer.”

M. Highland's Comment: This is not backed by scientific data, in fact goat kids are significantly more likely to shed than are adult goats based on a 2016 pack goat surveillance study (n=571; 83 premises), performed by the USDA-ARS-ADRU.

In that goat study, 90% of (+) animals were <1 year old, 77% were <6 months old, multiple were ≤2 months. While no "peer-reviewed" published data to support either statement for goat kids, the USDA-ARS-ADRU data has been publicly presented and all data has been shared multiple times. All USDA-ARS-ADRU data from this study is available upon request.

Additional (scientific based) considerations for imposing *Mycoplasma ovipneumoniae* import testing:

- *M. ovipneumoniae* is not a regulatory/select disease agent (anywhere in the world)
- No official standardized and no validated regulatory diagnostic test exists for identifying positive (*M. ovipneumoniae* carrier/infected) animals
- Culture methods for *M. ovipneumoniae* have a low sensitivity (fastidious bacteria that forms very small colonies on agar)
- Sheep and goats can be intermittent nasal shedders (different result on different test dates)
 - Does this mean an animal is truly positive but only sheds periodically at a detectable level?
 - Does this mean that these animals are truly negative and pick up the bacteria from other animals in the herd/flock, then clear it, then pick it up, etc.
 - How many tests are enough?
- Serological testing that is commercially available (at only one state diagnostic laboratory) does not work in goats
- This serologic test is not usable for testing an individual sheep's carriage status – positive serologic animals may repeatedly test negative by nasal swab PCR testing
- Statement by ADFG regarding current testing methods:
https://www.adfg.alaska.gov/static/home/news/hottopics/pdfs/movi_data_summary_09_23_20.pdf

Update from Camelid Industry

Patrick Long, Alpaca Owners Association

The following is a summary of the Camelid industry in the U.S. in 2020:

- 1) Covid 19 has caused cancelation of many local, regional, and national shows in the alpaca community. At least locally, on farm sales are up slightly, possibly due to more at home time for farm owners and a trend for more small farms and movement out of urban areas.
- 2) Agritourism activities have slowed or are non-existent on many farms. State laws and guidelines vary from state to state and have made on farm events difficult or impossible to conduct for most farms.
- 3) People for the Ethical Treatment of Animals (PETA) released a video of alpaca shearing in South America with worldwide distribution. While only two or three alpacas were depicted in this video, PETA implied that all alpacas worldwide were sheared in this manner. This video is not typical of shearing that occurs on most U.S. farms or even on most farms in South American countries. Worldwide some major manufactures have stopped using alpaca fiber as a result of this video. Mills in South America and the Alpaca Owners Association have responded with rebuttal statements to counter this video. I feel impact on U.S. alpaca owners will be minimal as most U.S. producers market their products through home knitters and craft fairs.
- 4) Camelids have been affected by proposed regulations banning domestic near wildlife. Another report from this committee covers that topic, but pack llamas will be the most severely affected by these proposed regulations.
- 5) Camelids made the news with their unique heavy chain antibodies and their potential use in treatment of Covid 19 in people. Camelids and sharks have heavy chain antibodies, which are much smaller (15 kilodaltons vs 150 kilodaltons) than conventional antibodies. These heavy chain antibodies were discovered over 30 years ago by researchers in Belgium and are being used by many firms. (Ablynx and Abcore are two companies that have more detailed information on their websites).

Update from Goat industries

Joan Dean Rowe, University of California, Davis

Dr. Rowe gave an update on the goat industry beginning with a summary of the 2020 Impacts on Goat Industries, including the COVID-19 pandemic impact on goat industries, public events, community. She also discussed the impact that many recent natural disasters, western wildfires, storms/hurricanes, catastrophic weather disruptions, have had in 2020. Dr. Rowe then addressed some key emerging Issues in Goat Health and Veterinary Services including the FDA 5-year Plan - Antimicrobial Stewardship and the transition of currently available over the counter (OTC) medically important antimicrobials products to Rx only Label. She also updated the committee on Q-fever as ongoing existential threat to goat industries. *Coxiella Brunetti* infections in goats result in production losses but are also an occupational health risk and a public health risk. Concern about the possible impact on land use policy related to goat/sheep production at suburban interface and potential for liability across wide range of potential risk. There continues to be an urgent need for vaccines to prevent carrier state in livestock and human vaccine for public health. Dr. Rowe also discussed some ongoing animal health and industry/commerce threats, namely animal disease traceability (ADT). ADT in an increasingly complex environment for the goat industry. They are actively involved in addressing the complexities of goat industries from production units to pet enterprise industries as part of the need to develop an ADT program for the goat industry.

American Goat Federation Overview and Project Updates

Anita Dahnke, American Goat Federation

In 2018, the American Goat Federation (AGF) established the American Goat Initiative to operate as a national goat center to find and help fund research beneficial to the goat industry, to provide education and support to producers, as well as collaboration with other groups to benefit the goat industry.

In addition, AGF has worked with USDA for several years to promote USDA programs while providing services to goat producers. In late 2019 AGF, through cooperative agreements with USDA/APHIS began two projects of interest to this group. The first includes a field trial of prototype radio frequency identification (RFID) ear tags, applicators and readers in which AGF will work with manufacturers, recruit producers and evaluators, distributes tags, readers, and applicators, and record data about each tag, application and reading. A follow-up 6-month evaluations will be conducted to assess tag loss, infection rate, chip failure, reader failure and visual character fading. In addition, the AGF developed an education program about the National Scrapie Eradication Program and Q Fever and use proper management practices for control of the zoonotic disease.

AGF has recently entered into three additional cooperative agreements with USDA, Animal and Plant Health Inspection Service (APHIS), that include another agreement to provide Scrapie and Q Fever information that will continue all activities conducted under the FY-19 agreement and added presentations to encourage recordkeeping. This project will include promotion of the free excel-based recordkeeping-performance program for AGF members that is individualized to each producer and includes free technical support and provides advancement to the American Sheep Industry (ASI) National Sheep Improvement Program (NSIP) program, should the producer want extensive performance data. Also, a scholarship program has been created for youth ages 12 – 21 who submit a presentation on Scrapie or Q Fever. Applications are judged by a committee of AGF directors, advisors, and others. Applicants with qualifying scores receive a scholarship, as well as feedback on the accuracy of their information and quality of their presentation.

Another FY20 cooperative agreement focuses on developing a Secure Goat Supply Plan patterned after the Secure Sheep and Wool Supply plan and the Secure Dairy Supply plan. Due to the fragmentation of the goat industry and multi-uses for goats that put them in the public sector the Secure Goat Supply plan will include additional features. Design of this plan will involve major goat associations as well as state veterinarians and others. Lastly, AGF entered into a cooperative agreement with USDA to develop and test two Safe Handling Sheep and Goat Equipment prototypes. The prototypes will be installed at two different livestock markets in different parts of the country for testing. AGF, the ASI and manufacturers will work on this together. AGF will deliver, train market personnel and will make follow up visits to evaluate the usefulness and any need for changes. A video will be made showing how the equipment works to help promote the equipment to markets and commercial goat producers.

Committee Business:

The Sheep, Goat and Camelid Committee members discussed the response options supplied by USAHA leadership in reply to answers received on the 2019 committee resolutions. Following discussion, the committee agreed to the following:

2019 RESOLUTION 26 – Need for Ongoing Scrapie Research

Response is sufficient for the purposes of the resolution, no further action. Considered Completed.

2019 RESOLUTION 27 Q-Fever (*Coxiella burnetii*) Vaccine

Response is sufficient for the current time; however additional follow-up will be needed.

The response only addressed the first part of resolution regarding applications for licensure of candidate vaccines. We are satisfied that the USDA – CVB remains ready to receive applications for licensure of candidate vaccines. However, ARS did not provide a response to the second part of the resolution:

*“In addition, USAHA urges the USDA, Agricultural Research Service (ARS) to continue development of research models that could lead to the development of vaccines in the United States; the development of tests for accumulation and shedding of *Coxiella burnetii*; and identification of genetic tools for improved control of *Coxiella* infections, including reduced shedding. USDA-ARS should pursue vaccine candidates that can be cost-effectively produced in a Biological Safety Level-2 facility.”*

Recommended timeframe for follow-up.

a. Spring Government Relations Meeting

2019 RESOLUTION 28 Scrapie Eradication Program-Animal Identification

Response is sufficient for the current time; however additional follow-up will be needed. Recommend timeframe for follow-up: at 2021 USAHA meeting.

There being no further business to be brought before the committee the meeting was adjourned at approximately 2:42 p.m.

REPORT OF THE SUBCOMMITTEE ON SCRAPIE AND IDENTIFICATION

Chair: Cheryl Miller, IN
Vice Chair: Larry Forgey, MO

The Subcommittee met on October 15, 2020, on a virtual platform, from 12:00 to 2:00 p.m. EST. There were a maximum of 130 people listening to the session at one point. The meeting was called to order by the chairman, Dr. Cheryl Miller. After introducing herself and the vice-chair, Dr. Larry Forgey, she read the subcommittee mission.

Presentations and Reports

USDA-APHIS Scrapie Program

Diane Sutton, USDA, Animal and Plant Health Inspection Service (APHIS), Veterinary Services (VS)

Scrapie Eradication Program Results*

- The National Scrapie Eradication Program made progress in FY 2020.
- There were no new infected or source herds in FY 2020. There was one new infected or source herd in each of FY 2018 and FY 2019. Both were found through goat slaughter surveillance.
- The last confirmed classical scrapie positive animal was in June 2019 in a goat. The last confirmed positive sheep was in October 2018.
- When first measured in FY 2002-2003, the percentage of cull sheep sampled at slaughter that tested positive for classical scrapie was 1 in 500. Since the last classical scrapie case in June 2019, APHIS has sampled over 39,000 animals and no cases of classical scrapie have been confirmed.
- Nor98-like scrapie was confirmed in two sheep sampled at slaughter in May and August 2020. The World Animal Health Organisation and APHIS have determined that Nor98-like scrapie is not a disease of trade concern.

Surveillance*

- Since the scrapie slaughter surveillance program began in FY 2003, over 664,000 samples have been collected.
- As of August 31, 2020:
 - 31,129 animals have been sampled for scrapie testing in FY 2020.
 - 29,680 RSSS samples and 1,449 on-farm samples
 - Of which 24,308 were sheep and 6,821 were goats.
- Surveillance was down about 20% in FY 2020 due to Covid-19 restrictions.

Slaughter Surveillance Genotyping Pilot Project

- APHIS is genotyping sheep at two large collection sites to reduce costs
- Only specimens from genetically susceptible sheep are tested for scrapie
- 71% samples were considered genetically resistant or genetically less susceptible
- To date, none of the 1,393 samples from genetically susceptible sheep have tested positive

Scrapie Resistance Genetics in Goats

- Recent research indicates that some goats have genetic resistance to scrapie.
- Amino acids S and D (D is rare in U.S.) at codon 146 and K at codon 222 appear to provide some resistance and may be like R in sheep
- NVSL is in the process of developing a proficiency test for approval of laboratories.
- If infected goat herds are identified APHIS will consider doing genetic based pilot project clean-up plan.
- APHIS is conducting a survey to determine the prevalence of scrapie resistance in goats.
- 3,000 geographically representative goats from routine slaughter and on-farm surveillance will be tested for codons 146, 211 and 222.
- Approximately 1,600 samples have been submitted to NVSL to date

Scrapie Flock Certification Program (SFCP)

As of August 31, 2020, there were 237 flocks participating in the Scrapie Free Flock Certification Program (SFCP). Statuses of these flocks were 41 export monitored, 41 export certified, and 155 select monitored flocks

*As of August 31, 2020. FY 2020 numbers are not final and may change.

Scrapie Review and Research Update Presentation Summary

Eric Cassmann, USDA, Agricultural Research Service (ARS), National Animal Disease Center (NADC)

Scrapie Review

Disease cause, transmission, pathogenesis, testing, genetics, classical versus atypical.

Research Updates

Sheep Scrapie - Atypical Scrapie Transmission

Atypical scrapie brain homogenate was transmitted to sheep with three different genotypes. The disease phenotype was retained upon transmission. Early sites of scrapie prion accumulation included the cerebellum and the retina.

Lysine (K) at codon 171

Sheep homozygous for lysine at codon 171 that were orally inoculated with classical scrapie brain homogenate did not develop scrapie during a six-year study. Heterozygous QK171 sheep seem to be less resistant than QR171 genotype sheep.

Interspecies transmission - CWD from mule deer in sheep

A second passage study that took sheep brain homogenate from an original mule deer CWD inoculum found widespread lymphoid dissemination of CWD prions. Distribution of CWD prions in sheep brains and western blot analysis revealed similarities to sheep scrapie. Research is ongoing to study the possibility of oral transmission of CWD to sheep.

Scrapie Review and Research Update

David A. Schneider, Animal Disease Research Unit

Susceptibility of small ruminants to scrapie infection is highly influenced by genetic factors, most notably variations in the prion protein gene (PRNP) that change the amino acid sequence of the prion protein (PrP). We have demonstrated strong resistance of goats bearing genetic variation that changes the amino acid at position 222 (from Q to K, represented Q222K) or at position 146 (N146S) of the prion protein. These variations caused significant resistance to infection by oral exposure to infectious placenta at birth. Tissues from the oldest surviving goats are to be checked for infectious prions by inoculation of transgenic mice highly susceptible to scrapie prions (tg338 mice). To date, tg338 bioassay has not detected infectious prions in the brain from Q222K goats, and the two oldest N126S goats are still alive at 11 and 12 years of age. An oral inoculation study to determine the effects of the GS127 variation. Now in its last year, about two thirds of the inoculated goats have been culled. The preliminary results demonstrate strong exposure was achieved as evidenced by all GG127 goats (the fully susceptible genotype) becoming positive for the misfolded prion protein - PrP(Sc) - in lymphoid and brain tissues by 18 months of age and clinically affected by 36 months of age. In contrast, no clinical cases have been observed in GS127 goats even though all (to date) have been determined positive for infection by 36 months of age. The progression of local tissue accumulation and spread of PrP(Sc) appears greatly reduced in GS127 goats.

It is long known that sheep genotyped as PRNP RR171 are strongly resistant to infection by typical forms of scrapie (a.k.a., classical scrapie) but not to some atypical forms, including those referred to as Nor98 or Nor98-like scrapie. To evaluate the risk for natural transmission, four ewes bearing the RR171 genotype were successfully infected with Nor98-like scrapie and bred for up to seven years, producing progeny and placentas for evaluation. While accumulation of PrP(Nor98-like) was generally absent from the placentas collected, very small amounts of a proteinase K-resistant PrP were more frequently detected in placentas shed from each ewe as they aged. Representative placental samples from each ewe were inoculated into tg338 mice: infectivity was not detected in placental samples from three of the infected ewes but one in ten tg338 mice did indicate possible transmission from a placental sample of the fourth ewe. Importantly, natural transmission from these infected ewes to their progeny has not been observed to date.

Lymphoid accumulation of PrP(Sc) is typically associated with the highly transmissible form of scrapie, classical scrapie, in genotype-susceptible sheep and goats (QQ171). In the past few years, two separate inconclusive cases of scrapie-like protein accumulation in lymphoid tissue were detected in young RR171 sheep. Limited to testing residual samples of formalin-fixed tissue from one of these cases, infectious scrapie prions have not been detected by bioassay in tg338 mice nor by serial protein misfolding cyclic amplification (sPMCA) assay. The inconclusive samples from the second case are not yet available for similar testing. However, PrP(Sc) accumulation has not been detected in any of the fresh

tissue collected from the source flock, which included late term pregnancy placenta and many tissues from sheep related to this second inconclusive case. Sequencing PRNP of flock mates has not revealed coding variations that could explain the unusual staining by only two of four anti-prion antibodies.

Subcommittee Business:

- Two resolutions from 2019 that were associated with the scrapie eradication program and USDA's responses were emailed out prior to subcommittee meeting. The responses will be reviewed in the parent committee, Committee on Sheep, Goats, and Camelids.
- Dr. Sutton reported that APHIS agreed to continue the current free tag policy through FY 2022.
- There was no old business from 2019.
- Dr. Cheryl Miller reported to the subcommittee that this was her final year as chairman. Dr. Larry Forgey agreed to move forward as the subcommittee chair and Dr. Larry Holler agreed to become the subcommittee vice-chair.
- Dr. Jean Rowe moved that the meeting be adjourned. Dr. Ben Smith seconded this motion.