USDA Agricultural Research Service

Sheep Trails

USDA ARS Sheep Industry Stakeholder Update

Calendar

Jan. 27-30: ASI Convention

March 10: PolyPay ewes begin lambing

May 1: Katahdin mature ewes begin lambing

May 20: Katahdin ewe lambs and Comp. IV ewes begin lambing

Sept. TBD: Select Breeding Stock Sale

Dale Bumper Small Farms Research Center

6883 South State HWY 23
Booneville, AR 72927
https://www.ars.usda.gov/southeast-area/booneville-ar/dale-bumpers-small-farms-research-center/

U.S. Sheep Experiment Station

19 Office Loop
Dubois, ID 83423
https://www.ars.usda.gov/pacific-west-area/dubois-id/range-sheep-production-efficiency-research/

U.S. Meat Animal Research Center

PO BOX 166
844 Rd 313
State Spur 18 D
Clay Center Nebraska 68933
https://www.ars.usda.gov/plains-area/clay-center-ne/marc/

In This Issue:

USMARC Director's Pen!

Hello from USMARC and welcome to the first edition of Sheep Trails!

It is our great pleasure to be bringing you this first edition of Sheep Trails, our stakeholder update and research report! Our goal is to periodically provide the sheep industry with new research and news of interest to the sheep industry. And, we have a lot of good news to share!

To start, please see several outstanding research reports for your review in this edition. We are excited about our growing research program and our ARS and external research partners! We are now even more aggressively building collaborative partnerships with sister ARS locations, with academia and with industry stakeholders. We also greatly value the stakeholder support we receive, and we have been relying on our critical producer stakeholders a great deal lately as we move forward on several research and program fronts.

For example, we developed a "Blue Ribbon Panel" (BRP) of industry experts to provide us with a comprehensive program review. Our panel includes producers and industry leaders, scientists, animal care staff, and other USMARC stakeholders. The BRP meets periodically on the Center, with an eye on improving overall animal husbandry, performance, and management. The BRP recommends improvements in all programs and facilities, and monitors progress and implementation. We also contrast USMARC program performance with industry benchmarks to identify areas needing improvement and to monitor progress over time.

To say that the BRP program has been successful would be a gross understatement. The panel meetings have provided valuable guidance and we are using them to promote continuous improvements in both sheep management and research programs. We look forward to every visit as we look to the future!

However, the BRP effort is only one of the core focus areas of our newly implanted Strategic Plan for "Sheep Camp". Several other focus areas are also included, such as continuing education programs, redefining our research populations, improving overall management, improving the grazing resources, improving parasite management and control, and developing a strategic vision for facilities modernization. All of these efforts are ongoing, including the final design for a state of-the-art lambing facility to be completed when funding is available. Exciting stuff and a bright future!

Together these efforts are supporting a proactive and interactive relationship with our colleagues at APHIS, who have been charged with providing annual inspections for the Center. Our interactions with APHIS are considered opportunities to strengthen our already strong programs for animal care and animal husbandry, and APHIS is sure to be a partner in our ongoing success.

Of course, we are very excited about our growing research programs and our expanding collaborations. We have rebuilt our Suffolk ewe flock at USMARC through the purchase of some of the top females available in the industry for growth and carcass merit. These ewes are now on-site for the initiation of an industry driven "terminal sire" project. We continue to improve and grow the "Composite IV" (½ Romanov, ¼ White Dorper, ¼ Katahdin) program and the Romanov flock. And we are expanding our work in the PolyPay and Katahdin breeds; and adding additional

support to the National Sheep Improvement Program. You will hear more about these initiatives in the future!

We are also excited to have Dr. Tom Murphy on board, as well as a new visiting scientist to the sheep research team! Dr. Stephan Wildeus who has joined us on sabbatical from Virginia State University, where he has led a small ruminant research program since 1992. Stephan is a native of Germany and completed his degrees in Animal Science with a B.S. from Montana State University and a Ph.D. (Reproduction) from James Cook University (Townsville, Australia). After a Post-Doc at Texas A&M University, Stephan conducted research at the University of the Virgin Islands for 7 years before moving to VSU. Stephan's research has a broad scope but generally focuses on improving artificial insemination in sheep as well as evaluating hair breeds in accelerated lambing systems. While at USMARC, Stephan will work with Drs. Freking and Murphy, and other scientists to evaluate factors influencing ewe reproductive performance in accelerated systems as well as ram breeding capacity. Stephan's sabbatical will consist of 2 separate 3-month visits and is being funded by the USDA ARS 1890 Faculty Research Sabbatical Program.

Lastly, we are looking to expand our research programs and impact through new and expanded research collaborations. We are working with our sister locations in ARS to describe a Sheep Systems Research Consortium, and hope to be putting that program in motion very soon. The program will also include our land grant university partners as well! And, we have many other projects developing that promise to produce tremendous benefit to the sheep industry.

So, we are excited, optimistic and looking to the future! Please join us on our journey forward and let us know how we can make our programs even better. We need your support for our research programs, for our producers and stakeholders, and in Washington DC. Help us to help you!

All the best!

Mark Boggess

CENTER DIRECTOR

Welcome

Alexa Johnson

Welcome, everyone to our first USDA ARS sheep industry update. This first update is centered towards U.S. Meat Animal Research Center with plans to included the other locations more in-depth for the future updates. We look forward to interacting with a tremendous range of sheep industry leaders and I want to extend a thank you for allowing me to be a part of it. I am Alexa Johnson, the Communications Specialist, for the USMARC. I was raised around agriculture and grew up participating in 4-H and FFA promoting a lifetime interest in animal production. I have two older siblings who I helped with their projects until I had my own and even then, continued to help them. Needless to say, my passion for the agriculture industry started young, making me appreciate the reward received after having spent the time and put forth the hard work to get my steer or heifer ready to show. Success was achieved as the quality of my livestock improved, my knowledge increased, and I strengthened my skill set, which drove my passion. This passion has helped direct the professional goals and objectives I have set for myself.

In the first summer after high school, I started my initial internship with the cow/calf unit at USMARC. That fall I attended the University of Nebraska – Lincoln, where I majored in Animal Science and Grazing Livestock Systems with a minor in Beef Industry. During my time at USMARC, I was introduced to many of the remarkable USDA scientists leading the tremendous programs that USMARC is famous for, and collaborators including, Dr. Mary Drewnoski, an Extension and Research Beef Specialist at UNL. After enrollment at UNL, I began as a student worker for Dr. Drewnoski and participated in her research, the research of her graduate students, and was fortunate enough to do my own research project.

When I graduated with my bachelor's degrees in May 2019, I started at USMARC full-time in the cow/calf unit overseeing a Fall Cow Calving project of Dr. Harvey Freetly's and Dr. Drewnoski's. However, when the communication specialist position became available, I honestly did not think anything of it. In time, I was asked if I had interest in the position and was encouraged to apply. At that point, I realized there is no time like the present to expand my knowledge and embrace the opportunity to work more broadly with the agriculture industry rather than only in the beef cattle sector. I stepped into this career in June of this year. My eyes have been opened by the breadth of research being completed at USMARC. The more involved I become, the more I understand how big of an impact USMARC has on the livestock industry.

In summary, I truly appreciate this opportunity to gain a real understanding of the sheep industry and to now proactively support all sheep industry stakeholders with this information and outreach effort from USMARC and from our partners around the World! Thanks for all you do for the sheep industry!

Meet the USMARC Manager

Alexa Johnson

Mark Hoogendoorn grew up in western Iowa on a small farm raising cattle, sheep and pigs. After high school graduation in 2005, Mark attended Iowa State University to pursue a Bachelor of Science Degree in Dairy Science. In 2006, he started to compete in sheep shearing competitions across the United States. Mark traveled from California to Michigan and everywhere in between competing for the next 10 years. After college graduation in 2009, he began working for the industry shearing sheep and started a flock of his own. He raised 200 ewes and traveled across the Midwest while he continued to compete in shearing competitions.

As Mark sheared, he had the opportunity to see all aspects of sheep management. He was on nearly 100 different operations per year. The operations varied from range production systems in Montana, to an intensively managed flock with an accelerated lambing program in Northwest Iowa. One of his most exciting opportunities landed in Tintinara, Australia to shear for a contractor. One of his most exciting competitions included National Sheep Shearing Champion in 2012 at the Rapid City Stock Show in Rapid City, South Dakota. In 2015, he was given the opportunity to travel to Ireland to represent the USA in the world contest.

Mark has been a member of the Pipestone Lamb and Wool program for 10 years. As his passion for the industry continued to grow, he came across the sheep operations manager opening here at the Meat Animal Research Center. Mark understood and realized the impact MARC has on the industry and wanted to apply to be a part of it. Mark started in August of 2019, and has since increased sheep identification using an electronic identification system. He has created a plan for a fall lambing flock of Polypay and Romanov breeds and has built a healthy culture and sense of ownership with the sheep care team. When Mark has spare time, he enjoys going golfing with friends or fishing. Mark is excited about the future of the sheep operations and the opportunity to continue to lead and guide the sheep operations on Center.

USMARC Blue Ribbon Panel Presentation Summary

Sheep Genetic Research Overview

Dr. Brad Freking

Brief summaries and updates from most of the current ongoing sheep research projects were presented with a more substantial look into the parity 5 data from the maternal and lamb behavior experiment. First discussed was some new information observed from the recently completed Ovine Progressive Pneumonia (OPP) experiment that evaluated the relative susceptibility of haplotypes 1 and 4 for the gene TMEM154. Ewes that reached the end of the experiment and were genotyped as 4,4 homozygous animals were euthanized on center and status of lung and mediastinal lymph tissues were evaluated. Four ewes were serologically negative for OPP and 4 were positive having serologically converted between 21 and 40 months prior to euthanasia. Despite positive serological tests and the substantial length of time since conversion, none of these ewes exhibited any evidence that the disease was progressing and causing disrupted lung function or enlargement of the lymph tissues that are hallmarks of OPP. While genotypes 1,1 and 4,4 are both equally less susceptible to becoming infected with OPP, it was noteworthy that 4,4 animals that tested positive seemed to not have advanced to more severe stages of disease. This project would not have been possible without, Mike Heaton, Aspen Workman, Mike Clawson, and Carol Chitko-McKown contributing.

The next project discussed was the continuing evaluation of three maternal line of sheep for low input production systems. The breed composition of a composite population (CIV) created to improve low-input pasture lambing production systems is ½ Romanov, ¼ Katahdin and ¼ White Dorper. This composite was directly compared to Katahdin (KT) and Polypay (PO) as industry standards for prolific hair and wool breeds, respectively. Pasture lambing with a low-input production system was utilized for the experiment designed to estimate line differences in lamb production through four parities. Three replicates of ewe lambs (about 70 per breed per year) entered the experiment from 2013-2015. One-half of all those ewes were evaluated under straight bred mating systems and the other half were mated to Texel terminal sires. Four years of performance for each replicate under the pasture lambing production system was recorded (2014-2019). Performance of CIV ewes exceeded that of PO and KT ewes by a rather remarkable 0.4 lambs at weaning per ewe exposed to breeding. After completion of the fourth parity, a subset (n=120 per year; 40 per breed) of these ewes was selected for more intensive evaluation

1/2 Romanov

1/4 Katahdin

1/4 White Dorper

during a fifth parity (2018-2020). Criteria for selection was to identify those that were previously most successful (HI group) weaning lambs and those that were least successful (LO group) weaning lambs at approximately similar levels of prolificacy. A small subset of barren ewes was identified and excluded from this evaluation but contributed to measurements of uterine and ovarian function. Each year 40 ewes per breed were selected for this evaluation, split evenly between prior purebred and terminal sire mating systems.

The overall objective of the fifth parity experiment was to provide more detailed information regarding potential differences among these breeds in regards to lamb or ewe behavior at parturition, prevalence of Ovine Progressive Pneumonia (OPP), udder morphology, and incidence of mastitis during early and peak lactation that contributed to differences observed and accumulated to weaning under the previous pasture-based system.

Significance levels for factors affecting key ewe productivity traits for parity 5 evaluation

Source	df	Number of Lambs Born	Number Ewe-reared lambs weaned	Ewe-reared Wean Wt, lbs
Year	2	0.52	0.03	<0.0001
Breed	2	<0.0001	<0.01	0.09
Production System (PS)	1	0.65	0.67	0.95
Weaning Group (WG)	1	0.47	0.02	<0.01
Breed x PS	2	0.70	0.36	0.48
Breed x WG	2	0.36	0.62	0.84
PS x WG	1	0.25	0.70	0.82
Breed x PS x WG	2	0.80	0.50	0.63

The evaluation of the ewes with differences in total number of lambs weaned involved mating to terminal sires for a fifth parity, with lambing occurring in B-32 of Area 25 to allow post-parturition camera recorded observation of behavior traits. Estrogen to progesterone ratios from plasma samples from ewes near the gestational endpoint will be evaluated and correlated to maternal behavior differences. Ewe maternal behaviors being recorded include grooming, suckling facilitation, sniffing/nosing, butting, or withdrawal / abandonment. Individual lamb behavior traits will be evaluated for time after parturition until standing, latency in seeking suckling, and sucking behaviors. Over the course of this 3-year experiment, hundreds of thousands of images (every 60 seconds) have been captured from multiple camera views in B-32 to allow capture of the described phenotypes targeting the first two hours after parturition before the sheep crew intervenes to place ewes and lambs in jugs. Additionally, udder morphology traits were recorded, and milk samples collected at approximately 5 and 35 d post-lambing for detecting OPP virus infection and mastitis phenotypes.

For parity 5, the average drop rate (lambs born per ewe lambing) for CIV ewes was 2.60; the average for KT was 2.23; and the average for PO was 2.35. All of these means are substantially higher than the industry average and have provided challenges to the ewes and lambs to express behavior traits that would enhance weaning survival. The designed weaning group treatment successfully identified ewes similar in prolificacy ($P = 0.47$) but differed in number lambs weaned ($P < 0.05$) regardless of breed. Effect of high versus low weaning survival group was nearly as big as any breed differences for weaning traits. Greater weaning success could be attributed to several factors including, udder conformation, incidence of sub-clinical mastitis, and maternal behavior effects. The vision going forward would be to discover and utilize genomic association information to improve lamb and ewe behavior traits (within and between breeds) that could be used to improve performance under less extensive production systems.

The next part of the discussion revolved

around data collected on the base flock of CIV ewes and lambs during the 2020 lambing season. The CIV population has typically lambed on pasture with limited human intervention but was lambed in the lambing barns during 2020. This allowed us to record phenotypes of specific lambing date and birth weight not previously available. The CIV ewes when exposed to multi-sire breeding groups during December mating lambed within a very unusually tight window, which impacts planned observation requirements during pasture lambing. Nearly 90% of the ewes exposed lambed within the first 17 days of the lambing season and 95% of ewes exposed had lambed by day 21. Of those that lambed, 80% of ewes across all ages produced twins and triplets and importantly, the average birth wt of triplet lambs was only 0.6 lb less than the average birth wt of twin lambs. This data provided insight into perhaps a key component to the success of the breed rearing triplets on pasture.

The last part of the discussion revolved around an update on sheep genomics efforts at USMARC. Projects are in place to establish an in-house genotyping platform for parentage and known genetic markers and to study genetic variants discovered in Romanov and Katahdin breeds for a gene previously associated with high ovulation rate in sheep. Additionally, the very successful effort to produce haplotype-resolved whole genome assemblies for the Romanov and White Dorper breeds using the trio-binning approach developed by Tim Smith was summarized. Mike Heaton also contributed to the design of the assembly project. Estimated continuous

Genome Assembly Comparisons

Reference Genome	Breed(s) of sheep	Contig N50 (Mb)	LG50 (contigs)	Number of contigs	Release date
Oar_v3.1	Texel	0.07	545,914	2,352,347	2012-2014
Oar_v4.0	Texel	0.15	5,008	48,482	2012-2015
Oar_rambouillet_v1.0	Rambouillet	2.57	313	7,486	2017
Oar_rambouillet_v2.0*	Rambouillet	42.39	25	1,344	(in progress)
Trio-binning F1 approach	White Dorper Romanov	82.5 78.2		1157 499	(in progress)

contig lengths for these two assemblies derived from a single cross-bred lamb were nearly double the best assembly known for sheep. A perfectly completed genome for sheep with no gaps would be in 28 distinct (26 autosomal chromosomes and the X, and Y) continuously ordered DNA sequences from one end of each chromosome to the other end. The initial assembly created by the trio binning approach before any additional efforts to join separated segments was already down to 499 distinctly ordered sequences (longest scaffold is 241 Mb) for the Romanov haplotype; the White Dorper haplotype is at 1157 distinctly ordered sequences (longest scaffold is 151 Mb). The previous best assemblies available for sheep number in the several thousand's range for distinctly ordered pieces (and those do not have haplotype resolution!). Our preliminary results confirm the feasibility of using trio binned reads for the creation of an accurate haploid genome for two distantly related individuals within the same species. This will have dramatic impacts on extrapolation of genomic data for the CIV population at USMARC as we go forward.

Current and Future Sheep Research at USMARC

Dr. Tom Murphy

Dr. Murphy presented current and future sheep research plans at USMARC beginning with additional results from the maternal behavior study outlined by Dr. Freking. The primary focus of this experiment was to compare ewe and lamb behavior between ewes with differences in weaning success (high vs. low) in their previous 4 parities. Another component of the study sought to quantify variation in udder morphometry and health which might impact lamb survival. Mastitis is caused by a bacterial infection of the mammary gland and is common reason for culling ewes. However, most mastitis research has focused on dairy cattle and cost-effective strategies to mitigate its occurrence in sheep are presently lacking. Additionally, a ewe's udder conformation likely impacts her lamb's ability to adequately nurse but consistent scales to identify the "ideal" udder structure are not widely used. Preliminary results from this experiment suggest that ewes with low weaning success had a greater occurrence of unsymmetrical udders compared to high weaning success ewes (25% vs. 11%), a greater occurrence of palpable intramammary masses (28% vs. 16%), and a greater frequency of subclinical mastitis (26% vs. 13%).

		Weaning Group	
Trait	**Level**	**High**	**Low**
Udder symmetry	Symmetrical	89%	75%
	Slightly/very unsymmetrical	**11%**	**25%**
Intramammary masses	0	84%	72%
	≥ 1	**16%**	**28%**
CMT score	Low	51%	48%
	Medium	36%	26%
	High	**13%**	**26%**

The remainder of Dr. Murphy's presentation focused on recent efforts to establish genetic reference flocks at USMARC and collaborating institutions. The National Sheep Improvement Program (NSIP) is the U.S. sheep industry's source of estimated breeding values (EBV) which are currently the most accurate predictor of an individual sheep's genetic merit for economically important traits. Current traits for which NSIP EBV are calculated are limited to those that are easily recorded (number of lambs born/weaned and lamb pre- and post-weaning growth) and traits that can be measured inexpensively by trained technicians (fecal egg count and ultrasound loin muscle/backfat depth). However, many other traits are economically important but too difficult or expensive for sheep producers to measure so few tools exist to aid in their genetic improvement. A reference flock is one which adequately samples industry relevant genetics to develop new selection tools for industry use. For example, by identifying influential rams of a given breed, mating them to USMARC ewes, and measuring novel traits in their progeny, it is possible to develop new EBV and possibly identify genomic regions associated with performance. This effort began in the USMARC Katahdin flock where proven rams from key regions throughout the country were identified and mated to ewes in 2019. Katahdin ewes were sampled near lambing and at weaning for intramammary health, udder and teat morphometry, internal parasitism, foot health, ovine progressive

NSIP
National Sheep Improvement PROGRAM

pneumonia virus infection, and incisor wear. Additionally, weaned market lambs will have feed intake, growth, respiratory health, and carcass characteristics recorded on them.

This effort will be greatly improved by including other research flocks that rear common breeds in a variety of production environments. To aid in these efforts, USMARC has begun exchanging breeding sheep with USDA ARS Dale Bumpers Small Farms Research Center (Booneville, AR; Katahdin) and USDA ARS U.S. Sheep Experiment Station (Dubois, ID; Polypay and Suffolk). Additional university flocks will also be identified in the coming year. The scientists involved in these projects are hopeful that new genetic selection tools will be developed to aid in the improvement of sheep health and productivity.

USMARC Sheep Operations Update and Progress Report

Mark Hoogendoorn

The USMARC sheep flock experienced a very successful spring lambing in 2020. There were 1,370 head of ewes exposed with a 90% conception rate and 2,424 lambs born. Lamb survival to weaning was nearly 90% across all breeds and environments the lambs were raised in. Lamb health post weaning has been phenomenal this summer due to the dry conditions. The ewes have maintained good condition through lactation and have been gaining weight all summer while grazing. The later born lambs were weaned from the pasture group in early-August but the early born lambs were weaned mid-May and sent to market in mid-August.

Flock Size (head)	1370
Conception Rate	89.16%
Drop Rate	194%
Percent to Nursery	8.74%
Nursery Survival	86.6%
Barn Lamb Survival	94.69%
Post Weaning Survival	97.6%
Overall Survival	89.56%

Currently, we are experiencing a drought of almost ten inches in this area leading to pasture health deterioration. The pastures have had little to no regrowth since early July and the short-term forecast looks bleak for any significant amount of rain. Sheep operations will have adequate grass to graze this Fall, but will see a large impact on our AUMs of dormant season grazing available for Winter. In hopes to reduce the impact, recently we started grazing 1,200 ewes on 20-acre paddocks. At this stocking rate the pasture utilization increases dramatically resulting in minimum amounts of feed wasted, and short time intervals on each paddock.

Our sheep operations held the USMARC Select

Breeding Stock Sale and Dorset Dispersal on September 12th in Sutton, NE. A sale like this has happened several years with the exception of last year and the crew and I were very excited to be able to hold one this year. There

were 375 head of breeding stock slated for the 11 a.m. start time. I am happy to announce that buyer attendance was strong with 20 onsite bidders and 6 internet bidders. We sold 362 head of breeding stock for an average price of $250 per head. Some highlights of the sale were the 5 purebred Romanov ewes selling for $800/hd, the top Katahdin lot of ewe lambs at $320/hd, the top Dorset at $235/hd, and the top Composite IV ewe lambs at $350/hd. September 12th was a very successful day for USMARC and those involved in the sheep operations.

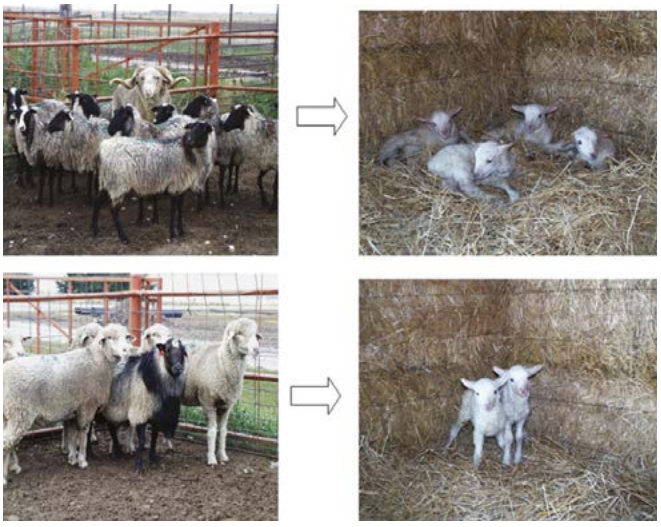
With a quick turn around our fall lambing Polypay and Romanov flocks began to lamb September 15th for 30 days. Halfway through lambing, we will begin our breeding season for the 2021 lamb crop. The USMARC sheep operations has had a busy year with a very busy couple months ahead of us, but we look forward to seeing the success with this new fall lambing flock. I want to personally thank each of you for your support of the USMARC Sheep Operations and your guidance for the research accomplished here.

USDA ARS Research Updates

Rambouillet and Romanov reciprocal breed effects on survival and growth traits of F1 lambs and on reproductive traits of F1 ewes

Brad Freking-USMARC

Contributor: Gary Bennett- U.S. Meat Animal Research Center



Improved ewe productivity has been identified as a critical priority to allow sustained competitiveness in the global market for U.S. lamb production. Efficiency of commercial sheep production could be improved markedly by greater industry use of specialized superior dam lines as maternal contributors in terminal crossbreeding systems. An important issue commercial producers would be faced with is the relative performance of replacement ewes sired by rams from superior maternal lines compared to

replacement ewes produced directly in the maternal environment of the superior maternal line. Rambouillet and Romanov breeds represent an extreme contrast in average litter size of roughly 2.0 lambs and thus are excellent resources to investigate these reciprocal breed effects. A large experiment with over 400 reciprocal crosses from those two breeds that produced over 3,400 lambs was used to investigate these potential genetic effects. Minimal differences were observed in performance of reciprocal cross ewes through their age 4 yr seasons for productivity, longevity, or progeny growth and survival. The practical outcome of this evaluation is that performance levels of both types of Romanov crossbred ewes were similar allowing the industry to produce the desired crossbred ewes without needing large purebred Romanov ewe flocks.

Development, selection criteria, and performance of Composite IV sheep at the U.S. Meat Animal Research Center

Tom Murphy-USMARC

Contributors: Brad Freking- U.S. Meat Animal Research Center, Gary Bennett- U.S. Meat Animal Research Center and John Keele- U.S. Meat Animal Research Center

Improving ewe reproduction and lamb survival has a greater impact on economic and biological efficiency than other production traits. Crossing super-prolific (e.g., Finnsheep and Romanov) and domestic breeds has greatly enhanced ewe reproductive performance in shed-lambing systems. However, most lambs in Intermountain West and Great Plains states are born on open range (28%) or fenced pasture (31%) and reports of ewe productivity and lamb survival from these prolific breed types in extensive systems are scarce. Eliminating the cost of shearing may also be advantageous in environments that don't favor the production of high quality wool. The Composite IV is a ½ Romanov, ¼ Katahdin, ¼ White Dorper hair sheep developed at the U.S. Meat Animal Research Center. Component breeds and selection pressure has resulted in a white, polled, maternal composite with predicted 62.5% individual and maternal heterosis. Composite IV sheep do not require docking or shearing and have been managed in a forage-based, pasture-lambing system which drastically reduces costs of production. Historical data of Composite IV sheep were analyzed. Lamb survival to and body weight at weaning were greatest for singles (0.90 and 19.9 kg, respectively), intermediate for twins (0.82 and 15.9 kg), and lowest for triplets (0.65 and 14.6 kg). Number of lambs born and weaned per ewe lambing were lower at 1-yr of age (1.55 and 1.24, respectively) than at 3- to 5-yr of age (2.20 to 2.23 and 1.75 to 1.82). Within mature ewes (2- to 5-yr-old), twin

litters were most frequent (58.7%), triplets intermediate (24.7%), and singles least (16.6%). Results indicated lamb survival and number of lambs weaned were greater but total weight of lamb weaned lower for Composite IV sheep than other breed types reported in range- or pasture-lambing systems. Planned research in this flock will evaluate terminal sire breeds, ewe productivity in shed- and pasture-lambing, and genetic tools for use in selection.

Sustainable approaches to parasite control in ruminant livestock

Joan M. Burke-DBSFRC

Contributor: J.E. Miller- Louisiana State University

Scanning electron microscopic image of Trichostrongylid L3 trapped in sticky loops of Duddingtonia flagrans after 8 hours

It is increasingly difficult to manage and control gastrointestinal nematode parasites in pasture based ruminant livestock operations due to the high prevalence of anthelmintic resistance. Farmers in the U.S. have lost as much as half their lamb crop by using ineffective anthelmintics. Anthelmintics alone are not sustainable and should be combined with alternative forms of control. Sustainable tools to employ in this endeavor include use of copper oxide wire particles and condensed tannin-rich plants, which target primarily Haemonchus contortus in small ruminants. Nematophagous fungi is another tool to reduce larvae on pasture and targets nematode larvae in feces of most livestock species. Finally, and perhaps most importantly, genetic selection is a tool that focuses on parasite resistance of the small ruminants and cattle. Producers should attempt to use as many tools as possible to minimize the need for pharmaceutical interventions and optimize animal production.

Effects of rearing triplet lambs on ewe productivity, lamb survival and performance, and future ewe performance

J. Bret Taylor-USSES

Contributors: David Notter-Virginia Tech University*, Michelle Mousel*- U.S. Sheep Experiment Station*, Timothy Leeds*- U.S. Sheep Experiment Station*, and Gregory Lewis*- U.S. Sheep Experiment Station

The number of lambs weaned has been recognized as the main factor affecting efficiency of resource use and profitability in sheep production. Considering that the U. S. ewe breeding inventory has been static for some time, producers are seeking ways to increase the number of lambs weaned per ewe. Over the past 30 yr, use of prolific sheep breeds such as the Finnsheep and Romanov has allowed major increases in ewe prolificacy. High frequencies of triplet and larger litters can be achieved, but, in extensive production, may not improve profitability and may instead lead to large increases in lamb mortality. With this potential dilemma in mind, we conducted a study to assess the effects of rearing triplet lambs on ewe productivity and ewe and lamb performance under extensive rangeland conditions. Based on our results, ewes that were required to rear triplet lambs weaned 0.20 more lambs per litter than ewes that reared twins, but at a cost of 0.75 additional dead lambs. We conclude that there is an intermediate optimum prolificacy level for extensive rangeland production. If the optimum prolificacy level is exceeded, removal and artificial rearing of surplus lambs are necessary to avoid unacceptable lamb death losses.

Responses of pregnant ewes and young lambs to ovalbumin immunization, antiovalbumin antibody transfer to lambs, and temporal changes in antiovalbumin antibody

J. Bret Taylor-USSES

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Newborn lambs are born without a fully developed immune system. In order for newborn lambs to have optimal health and the greatest chances of survival, they must acquire “passive immunity” by consuming their mother’s (i.e., the ewe’s) colostrum soon after birth. Colostrum is rich in important antibodies that protect lambs from common diseases found in lambing systems. Factors that affect how long these passive-transfer antibodies will protect a newborn lamb against disease are not well understood. Furthermore, the age that a lamb should be before it can respond to a vaccination is not exactly known. Therefore, our aim was to identify a management strategy that would result in the best antibody protection in newborn lambs. We compared vaccination of pregnant ewes before lambs were born with vaccination of lambs immediately after birth or at 28 days of age. We found that the ewe’s antibodies that were produced in response to vaccinations during late pregnancy were transferred to lambs via colostrum. However, vaccinating lambs immediately after birth may interfere with the ewe’s antibodies that the lamb acquired from the colostrum. When considering the optimal time to vaccinate a lamb, waiting until the lamb was 28 days of age was far superior to vaccinating the lamb at birth for initiating antibody production by the lamb. Overall, the results of this study support the recommendations to vaccinate ewes against common pathogens during late pregnancy and to ensure that lambs receive adequate colostrum soon after birth. The results of this study do not support the notion of vaccinating lambs immediately after birth, instead of inoculating late pregnant ewes and gaining the colostrum-mediated advantages of passive immunity.

Quebracho tannins aid in the control of Eimeria spp. and gastrointestinal nematodes in lambs and goat kids

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The objective was to examine the effects of supplementary quebracho on control of coccidiosis and gastrointestinal nematodes in lambs and kids. In Exp. 1, naturally infected lambs weaned (87.8 ± 0.4 days of age; day 0) in January (winter) were blocked by sex and randomly assigned (n = 10/treatment) to receive supplement with or without 100 g/lamb of quebracho for 28 days. In

Exp. 2, single or twin rearing ewes were randomly assigned into two groups, and naturally infected lambs were fed control (n = 28) or quebracho (100 g/lamb of quebracho tannins in feed; n = 27) between -28 and 21 days (weaning = day 0; 70.8 ± 0.1 days of age). In Exp. 3, weaned doe kids (57.6 ± 2.0 days of age) were randomly assigned to receive alfalfa (Medicago sativa) supplement with (n = 9) or without (n = 8) 50 g/kid quebracho or sericea lespedeza (Lespedeza cuneata) with quebracho (n = 8) for 21 days. Fecal oocyst count (FOC), nematode egg counts (FEC), fecal score, dag score (soiling around rear quarters), and blood packed cell volume (PCV) were determined every 7 days. Data were analyzed as repeated measures using mixed models. In Exp. 1, FOC decreased in quebracho-fed lambs (diet × time, $P < 0.001$) but FEC was similar between treatments during the feeding period ($P = 0.19$). Packed cell volume ($P = 0.19$) and fecal score ($P = 0.42$) were similar between groups. Quebracho-fed lambs had a greater dag score initially (diet × time, $P = 0.02$), but were similar by day 42 ($P = 0.72$). In Exp. 2, FOC remained low ($P = 0.02$), PCV tended to decrease ($P = 0.06$), but FEC increased on days 14 and 21 (diet × time; $P < 0.001$) in quebracho compared with control-fed lambs. Quebracho-fed lambs had lower fecal score (diet × time; $P = 0.005$) but higher dag score (diet × time; $P < 0.001$). In Exp. 3, FOC of kids fed quebracho (alfalfa or sericea lespedeza supplement) was lower than control ($P < 0.001$). Fecal score of kids fed sericea lespedeza compared with alfalfa were lower regardless of quebracho ($P = 0.01$). There were no differences among treatments for dag, FEC, PCV, or body weight ($P > 0.10$). Quebracho was effective in reducing FOC but not clinical signs of coccidiosis in both lambs and kids, and may not be highly digestible in lambs as it caused loose stools.

Additional Publication References

Fleece and fiber characteristics of Rambouillet, Targhee, and their reciprocal-crosses at first shearing
https://www.ars.usda.gov/research/publications/publication/?seqNo115=373172

Phenotypic and genetic differences in Rambouillet lines divergently selected for reproductive rate over 50 years
https://www.ars.usda.gov/research/publications/publication/?seqNo115=373051

Status of evaluation of three maternal lines under pasture lambing management conditions at USMARC
https://www.ars.usda.gov/research/publications/publication/?seqNo115=357010

Evaluation of Rambouillet, Polypay, and Romanov-White Dorper x Rambouillet ewes mated to terminal sires in an extensive rangeland production system: Lamb production
https://www.ars.usda.gov/research/publications/publication/?seqNo115=339551

References for Publications Included

Rambouillet and Romanov reciprocal breed effects on survival and growth traits of F1 lambs and on reproductive traits of F1 ewes
https://www.ars.usda.gov/research/publications/publication/?seqNo115=358283

Development, selection criteria, and performance of Composite IV sheep at the U.S. Meat Animal Research Center
https://www.ars.usda.gov/research/publications/publication/?seqNo115=374426

Sustainable approaches to parasite control in ruminant livestock
https://www.ars.usda.gov/research/publications/publication/?seqNo115=365371

Effects of rearing triplet lambs on ewe productivity, lamb survival and performance, and future ewe performance
https://www.ars.usda.gov/research/publications/publication/?seqNo115=353708

Responses of pregnant ewes and young lambs to ovalbumin immunization, antiovalbumin antibody transfer to lambs, and temporal changes in antiovalbumin antibody
https://www.ars.usda.gov/research/publications/publication/?seqNo115=344623

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In the Press

Acknowledgement of Folks Involved in the Sheep Research

Gary Bennett, U.S. MARC
Carol Chitko-McKown, U.S. MARC
Mike Clawson, U.S. MARC
Bob Cushman, U.S. MARC
Mike Heaton, U.S. MARC
John Keele, U.S. MARC
Larry Kuehn, U.S. MARC
Clay Lents, U.S. MARC
Ron Lewis, University of Nebraska-Lincoln
Amanda Lindholm-Perry, U.S. MARC
Tara McDaneld, U.S. MARC
Jeremy Miles, U.S. MARC
Dave Notter, Virginia Tech University
Lea Rempel, U.S. MARC
Tim Smith, U.S. MARC
Whit Stewart, University of Wyoming
Jim Wells, U.S. MARC
Stephan Wildeus, Virginia State University
Aspen Workman, U.S. MARC

Research summaries from these scientists will be in future issues of Sheep Trails.

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