Sustainable Small Ruminant Production in the Southeastern U.S.

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Contents

SCC081: Sustainable Small Ruminant Production in the Southeastern U.S.

Project Administration

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Administrative Advisor(s): Erdogan Memili
NIFA Representative(s): Robert Godfrey, Kamilah Grant

Statement of Issues and Justification

Small ruminants remain a vital component of many small farms in the Southeastern U.S., providing milk, meat, and fiber, as well as a means to control brush. In addition to conventional and ethnic markets, there is a growing demand for grass-finished, organic, and local meat products (USDA, NASS, 2012, 2015). Small ruminants are challenged by gastrointestinal nematodes (GIN) due to loss of effective dewormers and warmer temperature much of the year. Minimizing the use of anthelmintics and focusing on other means of control (Whitley et al., 2014) such as fungus feeding addresses both conventional and organic production. The most promising means of GIN control is genetic resistance, or an animal's ability to resist infection with GIN. The National Sheep Improvement Program (NSIP) includes estimated breeding values (EBVs) for parasite resistance as worm egg count (Aaron, 2014) in sheep and goats. Research is needed on combining genomics with EBVs, consideration of additional EBVs of economic importance as well as wider use of EBVs by goats that are plagued by GIN to a greater degree than sheep. It is important to understand how the immune system functions in susceptible and resistant animals to fine tune selection for resistance. And, while the group has made great strides on forage management and condensed tannin-rich forages such as sericea lespedeza (Coffey et al., 2007) for GIN control, further research is needed to examine the importance of native plants with secondary plant compounds and meeting both production goals and GIN control with existing GIN-important forages and grazing systems. Similarly, little is known on integrating small ruminants and silvopasture. Trees provide shade to increase animal welfare particularly during summer months, opportunities for better forages to graze, and another revenue source.

In general, ruminant livestock production systems are most efficient if there is maximal reliance on fresh plant material consumed by the animals, with minimal use of harvested forage or other supplemental feedstuffs. However, this can be difficult to achieve because of considerations such as seasonal growth patterns of forage and browse plant species, varying environmental conditions, and changes in nutrient and energy requirements of animals in accordance with stage of production. And, this is becoming even more complex because of climate change, with more variable and extreme conditions expected in addition to shifting averages. There are numerous means by which these challenges are addressed, but which have not been adequately studied for goats, sheep, as well as co-grazing species. Examples include use of monocultures of annual or perennial cool and warm season grasses and legumes in different areas, mixtures of grasses, forbs, leguminous forages and trees, and browse plants, silvopasture, strategic supplementation, use of inexpensive byproduct or alternative supplemental feedstuffs, modified birthing time, careful selection of species, breed within species, and individual animals within breed for

specific production conditions, etc. Moreover, for goats and sheep, how such decisions affect the degree of infection with GIN and resultant impact on animal health and productivity are of paramount importance. Lastly, in order to most appropriately study these and other factors and manage animal and farm conditions, smart, real-time technologies should be developed, namely to characterize and monitor animal physiological conditions and behaviors indicative of well- being, nutritional status, and level of productivity.

Profitability of small ruminant production is closely tied to optimum reproductive function. Production efficiency is closely tied to the number of offspring available for marketing, and hence a direct function of number of lambs/kids born and surviving. Reproductive performance is affected by a variety of processes, this project explores the constraints and opportunities (1) resulting from seasonal reproduction in sheep/goats, and by (2) increasing the use of assisted reproduction on small farms. Sheep and goats are short-day breeders and traditional production systems use fall breeding/spring lambing. Such systems create seasonal peaks in lamb and goat supplies and does not meet the market demands for goat/sheep meat throughout the year. Research will explore the increased use of aseasonal germplasm and management tools, such as the male effect, to breed out-of-season and achieve a more continuous kid/lamb supply. Availability of extended or year-round breeding can be used to develop accelerated mating systems to increase efficiency of kid/lamb production. Use of assisted reproduction in small ruminants lags behind its use in other livestock species, and is compounded by the lack of approved products to control the reproductive cycle. Research here address cost effective assisted reproduction, ranging from estrus synchronization protocols, timing of artificial insemination, processing and storage of semen, and insemination techniques.

Because of dwindling resources for extension programs, it is imperative that we find a means to disseminate our research and transfer technologies developed from it. This will be achieved through online programs, websites, and train-the-trainer programs. These research and outreach priorities on GIN control, forage feeding programs, and improvements in reproduction require coordinated efforts of multiple research institutions, each contributing their specific expertise towards the design of integrated systems.

The U.S. relies heavily on imports of lamb and goat meat to satisfy domestic demand. However, this reality does not ensure greater market opportunity and thus profitability for small ruminant producers. Factors affecting the markets are scarcely understood. Small ruminant producers possess potential for greater profit if they can enter more lucrative markets than the local sale barn. Some small ruminant producers are using various strategies to increase the sale price of their animals or produce value-added items. Identifying these strategies and devising new methods of increasing product value will help increase farm profit and sustainability.

The number of institutions conducting sheep and goat research, as well as large ruminant research, has been declining, along with animal numbers and researchers/extension specialists. Hence, it has become more important to coordinate research/extension between institutions and cooperate on projects across stations to maximize available resources. Currently only one other multi-state regional project addresses small ruminants (NC-214: Increased efficiency of sheep production). There is limited duplication between the two projects, with NC-214 more national in scope, restricted to sheep research only, and with objectives that also address wool and dairy.

This project here has a more regional focus on the southeastern U.S., covers both sheep and goats, a strong extension/outreach component, and extensive representation by 1890 institutions.

Objectives

1. Utilization of gastrointestinal nematode (GIN) control methods including feeding *Duddingtonia flagrans*, forage/grazing management, and animal selection for GIN resistance.

2. Emphasis of forage feeding systems for year-round grazing to meet nutritional requirements that mitigate drought and other plant and animal stressors.

3. Strategies for the improvement of small ruminant reproduction.

4. Disseminate research results and information to stakeholders.

5. Identify producers' challenges and opportunities in marketing goats and goat products

Procedures and Activities

Objective 1: Methods of GIN control will include genetic and genomic selection, forage/grazing management, and selective deworming or the strategic use of anthelmintics and alternatives. Other control methods may include condensed tannin-containing forages, grazing systems, and nematode-trapping fungi (*D. flagrans*). Participating agencies include Fort Valley State University (**GA**), USDA ARS Booneville, West Virginia University (**WV**), University of Maryland Eastern Shore (**MD**), Tuskegee University (**AL**), Delaware State University (**DE**), Virginia State University (**VA**), Louisiana State University (**LA**), North Carolina State University (**NC**), Langston University (**OK**), Florida A&M University (**FL**), Prairie View A&M University (**TX**), and Tennessee State University (**TN**). Collaborating institutions to examine GIN resistant genetics and genotypes and relationships among the EBVs generated by NSIP are AR, WV, NC, DE, GA. The development of genomic enhanced EBVs and resistant genetic phenotypes will be explored by AR, WV, and collaborators. Trials at WV will measure specific immune responses of resistant breeds during a primary and challenge infection with *Haemonchus contortus* to elucidate mechanisms of immunity. Institutions to examine the best use of *D. flagrans* (BioWorma), which recently became available in the U.S., and integration of nonchemical control of GIN in conventional and organic production systems include GA, AR, LA, OK, FL, TX, TN, AL, and VA . One aspect of Bioworma use to be addressed is the necessity of daily feeding, such as if dietary inclusion every other day might suffice. Dose used will be based on manufacturer recommendations. Important measures in these Bioworma studies include FAMACHA score, fecal egg count, larval recovery from cultured feces, body weight change, examining feeding periods during lambing to dams, and to offspring at weaning

(approximately 60 to 120 days of age occurring in winter, spring, or summer). Studies involving condensed tannin containing forages including birdsfoot trefoil, sericea lespedeza, and native legumes will occur at all participating agencies to evaluate potential both as a forage (grazing schemes and fed fresh) and processed (hay, haylage, silage, pellets). That is, forages containing condensed tannins can be used in a variety of ways, such as grazing, feeding of hay, and use of commercially available sericea lespedeza pellets. The results of these trials will lead to an integrated strategy for controlling worms on commercial and breeding operations that manage conventionally or organically.

Objective 2: Cool-season and warm-season annual and perennial forages, including native grasses and legumes, will be established in conventional and organic pasture, evaluated and compared to determine forage availability and quality, stocking rate, and animal performance during different stages of production by AR and GA for sheep or goat production systems. At AL, silvopasture systems (mixed pines and hardwoods) with and without annual forages will be examined for goat production, and GA will consider benefits of silvopasture for sheep and cattle. GA will examine use of natives in a pasture system for pollinator benefits as well as improving diversity of the pasture system, providing additional quality summer grazing and possible control of GIN at the pasture life cycle stage. Native and other varieties of sericea lespedeza will be examined in a pasture system as a summer grazing/hay crop for small ruminants of mixed sexes and ages depending on time of year implemented by GA and AR. Supplementation with low cost feeds (soy hull and corn gluten feed) will occur at DE and VA.

Supplements of concentrate and leguminous trees browsed or consumed in a cut-and-carry manner will be compared with growing meat goats grazing grass/forb pastures in the summer at OK, with characterization of grazing behaviors in addition to feed intake, digestion, and performance. Also, in OK, low-cost accelerometers constructed from off-the-shelf components will be evaluated in relation to commercial units to characterize behaviors of goats and hair sheep such as grazing, ruminating, and idle, standing versus lying, distance traveled, and spatial-temporal movement. Tall fescue toxicosis continues to cause production, health, and welfare issues for small ruminants as it is an important southern cool season forage, but the endophyte-infected tall fescue variety persists more so than endophyte-free varieties. AR will examine markers (prolactin) for tolerance of fescue toxicosis in Katahdin ewes and potential genetic selection. Pregnancy and conception rate (ewes), body weight and condition (ewes and lambs), and incidence of foot and other health issues will be examined.

Objective 3: Work on assisted reproduction techniques in small ruminants will be carried out at a number of stations. Liquid semen AI with either fresh, cool-stored, or cryopreserved semen in goats will be conducted at TX, and DE. The research will evaluate insemination dose and volume, extender composition (animal vs non-animal protein source), synchronization of estrus/ovulation, timing of AI, and AI technique (laparoscopic, transcervical and intracervical). In sheep, semen collection, processing, storage, and AI protocols will be evaluated in VA. Techniques evaluated will be simple intracervical and transcervical AI with the use of a speculum to locate the cervix, the addition of antioxidants to a simple skim milk, egg yolk and defined non-animal protein extenders, the use of fixed timed AI following CIDR synchronization or the addition of estrus detection in the protocol, and reductions in semen dose currently in use

for (300 million sperm/ml) in liquid AI protocols. Stations will be cooperating in a number of these project VA, TX and DE.

In AR out-of-season breeding using multiple sires (Oct/Nov vs. Jan/Feb lambing), as well as impact of tall fescue toxicosis on reproduction in sheep will occur. This will include characterization of tolerant vs. susceptible ewes, determined by concentration of prolactin, relative prolificacy and maintenance of body condition, and management strategies to optimize reproduction in tall fescue grazed ewes. In VA work will continue on a transition from accelerated mating to semi-continuous lamb production system. This project will also continue to evaluate the forage-base needed to develop this to be a totally pasture-based system.

Objective 4: Producer workshops, which teach the use of integrated parasite control methods, will be taught throughout the region, with at least 5 conducted each year. Parasite control will continue to be an important educational focus. Efforts are strongly supported by the work in the other objectives. Local, county, and regional meetings will be held in each of the states. Efforts will continue to update extension field faculty on small ruminant production and management. Information for agricultural professionals including Extension staff and producers among others will be posted to various websites in each of the states, as well as the website of the including those managed by KY, GA, and MD2 (Maryland Small Ruminant Page at www.sheepandgoat.com; American Consortium for Small Ruminant Parasite Control at www.wormx.info). Efforts will be made to continue to support the eXtension Goat Industry as an online information source to producers.

Objective 5: Survey questionnaires will be developed with open and close-ended questions to survey goat and sheep producers as part of a regional project entitled 'Developing a sustainable small ruminant meat production and marketing systems for the Southeastern United States through an 1890 universities consortium.'. The questionnaire will include questions relevant to farm size and facilities, producers' demographic information (name, gender, education, etc.), local, regional, and national market outlets that producers are using, costs and inputs involved in production, challenges they are facing in marketing their product, their suggestions to overcome such challenges, advertising avenues, and more. Producers participating in all educational and outreach events to be conducted by the collaborating SCC-81 institutions will be informed about the survey and encouraged to participate in the survey. Survey booths will be installed at the relevant conferences, such as the National Goat Conference, Professional Agricultural Workers Conference, Small Farm Conference, annual conference of Southern Sustainable Agriculture Working Group, and Annual Farmers Conferences to be hosted by the collaborating SCC-81 institutions, and the conference participants will be informed and encouraged to take the survey. Extension educators and other agricultural professionals attending these conferences will be encouraged to disseminate the survey to their clientele. In addition, surveys will either be mailed to willing producers, conducted in face-to-face interviews, or as feasible based on participant producers. Moreover, social media, email, and other similar outlets will be used to reach out to a wider producer community for the survey. Based on the survey results, challenges faced by producers and the opportunities that they have realized within their locality will be documented. Strategies will be developed to guide producers to tap into available opportunities effectively.

Some strategies will be matching their production/breeding cycle with the high-demand time, such as different celebrations and festivities. Additional strategies will include keeping records of animal performance, expenses, and incomes, and use these pieces of information to calculate the sale price. Another strategy will be to create a local producers' coalition and work together for marketing their animals and products for the best possible price. Adding value to the product and selling value-added products may be a feasible strategy for some producers. Resulting from the tabulation of the survey results, a strategic document will be prepared and published. The document will serve as a valuable educational material for training and educating producers and professionals, who work with goat producers.

Expected Outcomes and Impacts

- Improved selection for sheep and goats resistant to GIN to reduce the need for deworming.
- Increased participation in NSIP.
- Increased use of artificial insemination and other reproductive management techniques.
- Increased use of alternative parasite control methods involving forages and forage management by producers.
- Improved forage-based systems for conventional and organic small ruminant production.
- Enhanced knowledge of small ruminant grazing practices that support diverse forage systems.
- Improved summer gains for growing lambs and kids on forage-based systems.
- Increased use of leguminous trees to provide supplemental nutrients of meat goats for increased economic returns.
- Enhanced knowledge of the development and use of inexpensive equipment to characterize grazing behavior of small ruminants
- Exchange of ideas and information.
- Coordination of specific research and extension programs to accelerate goals.
- Identification of critical research objectives.
- Improved outreach to scientific community and producers.
- Increased market awareness and marketing opportunities for producers.

Educational Plan

Technical committee members of this project have been involved in organizing producer workshops and field days at their respective institutions. These events will be the basis of the educational and outreach activities of this project. The project will facilitate the coordination of these activities and provide a range of subject matter expertise in the selection of the presenters at workshops and field days. Members will prepare articles for publication in industry magazines. There are several participants from 1890 Land Grant institutions that have a special

mandate to serve under-represented groups and small-scale, limited resource farmers. These groups have shown a particular interest in small ruminant production that will benefit from activities from this project.

Land Grant Participating States/Institutions:

FL, GA, MD, NC, TN, TX, VA

Non-Land Grant Participating States/Institutions:

ARS

Objective 1: Utilization of gastrointestinal nematode (GIN) control methods including selective deworming, forage/grazing management, and animal selection for GIN resistance

Fort Valley State University

Effect of feeding a blackseed meal-sericea lespedeza leaf meal pellet on gastrointestinal nematode and coccidia infection and animal performance in young goats. A. Neha, A. Shaik, S.C. Chelkapally, R.S. Kolikapongu, S.C. Namani, T. Erukulla, P. Batchu, N. Mendez, Y. Smith, D. Brown, N.C. Whitley, A.A. Pech-Cervantes, G.S. Dykes, V.R. Owen, G. Kannan, J.E. Miller, A. Siddique, and T.H. Terrill. https://doi.org/10.1016/j.vetpar.2024.110253

Objective: In this investigation, black seed (Nigella sativa), a shrub high in secondary antioxidant compounds, and sericea lespedeza (Lespedeza cuneata), a perennial legume high in tannins with anti-parasitic properties were combined to determine if two bioactive plants containing different types of secondary compounds can provide a stronger anti-parasitic effect than sericea lespedeza alone.

Procedure: In a 49-day trial, naturally parasitized 6–7-month-old intact male Spanish goats (n = 15/treatment) were fed pelletized feeds encompassing sericea lespedeza leaf meal (SL), a combination of black seed meal (BS) and sericea lespedeza leaf meal (BS-SL - 75 % SL, 25 % BS), or alfalfa (Medicago sativa, control parasitized; CONP), with an additional group of dewormed kids given the alfalfa pellets (Control treated; CONT). Weekly measurements of animal weights and samples of blood and feces were collected to determine the packed cell volume (PCV), GIN fecal egg counts (FEC), and coccidia fecal oocyte counts (FOC), respectively. All animals were processed at the end of the trial (60 total), with adult Haemonchus contortus worms recovered from the abomasum of each goat for counting and sex determination. Carcass weights were recorded after processing.

Results: Goats given the SL and BS-SL treatments had lower FEC ($P<0.05$) than the parasitized alfalfa (CONP) goats. At the end of the study, the SL and BS-SL groups' FOC values were lower ($P < 0.05$) than the CONT and CONP groups. A rise in PCV values was seen over time for all groups; SL, BS-SL, and CONT animals exhibited higher PCV values ($P < 0.05$) in comparison to the CONP goats. The parasitized goats fed SL-only pellets showed greater feed intake and animal body weights ($P < 0.05$) compared to goats fed BS-SL or alfalfa pellets. However, the treatments had no effect on the weight of the goats' carcasses. Although the H. contortus adult worm counts in the CONT goats (alfalfa-dewormed) were lower ($P < 0.05$) than in the CONP goats (alfalfa-parasitized), they did not differ from the SL or BS-SL animals.

Impact: Sericea lespedeza alone or in combination with blackseed meal seemed to control parasites as well as dewormers used in this study, indicating that adding blackseed meal would not be worth the extra cost at this time.

Evaluating the efficacy of bioelectrical impedance analysis using machine learning models for the classification of parasitized goats. Thomas H Terrill, Aftab Siddique, Tharun Tej Erukulla, Phaneendra Batchu, Sai Chelkapally, davia Brown, Kensley Stegall, Govind Kannan, Ajit Mahapatra, Sudhanshu Panda, Eric Morgan, Jan van Wyk. https://doi.org/10.1093/jas/skae234.518

Objective: Rapid identification and evaluation of animal health condition is one of the most important concerns when it comes to livestock productivity, particularly for small ruminants susceptible to infection from blood-feeding gastrointestinal nematodes, like Haemonchus contortus. The present study was designed to optimize the process of differentiating parasite infected goats from healthy goats.
Procedure: This study used male intact Spanish goats (n = 65), aiming to establish a proof of concept for the efficacy of bioelectrical impedance, specifically through the metrics of Resistance, and Reactance, in identifying the health status of goats. The research involved the development and comparative analysis of seven machine learning (ML) models, divided into four classification-based models and three regression models, to assess their capabilities in accurately classifying goats based on bioelectrical properties. The data for this study were gathered from live animals using CQR 3.0 (Sea food analytics), with measurements taken from both ear and tail ends to ensure comprehensive and reliable bioelectrical readings.
Results: Among the classification models evaluated, the Random Forest Classification model emerged as the most effective, demonstrating a validation accuracy of 71.8% and a testing accuracy of 77.1%. This was closely followed by the K-NN Classification model, which showed a promising testing accuracy of 86.7%. Conversely, the Support Vector Machines and Boosting Classification models displayed decreased accuracies, indicating variability in the performance of classification models in this context. The regression models, evaluated through metrics such as Mean Squared Error (MSE) and R-square, revealed the K-NN Regression model as the most proficient, with the least Test MSE of 0.13 and an R-square of 0.482. This suggests a moderate correlation and predictive capability in determining the health status of goats based on bioelectrical impedance measurements. The Decision Tree Regression and Support Vector Regressor models showed varying degrees of effectiveness, with the latter indicating a minimal R-square value, highlighting the challenges in applying regression models to this domain.
Impact: The conducted proof of concept research not only underscores the potential of bioelectrical impedance analysis in veterinary diagnostics, but also opens avenues for further refinement of ML algorithms in classifying and predicting the health status of farm animals. The outcomes of this study could significantly influence management strategies for small ruminants, offering a non-invasive, rapid, and potentially cost-effective tool for early detection of parasitism, thereby enhancing animal welfare and productivity in the agricultural sector.

Development of a Decision Support System for Animal Health Management Using Geo-Information Technology: A Novel Approach to Precision Livestock Management. Panda, S.S.; Terrill, T.H.; Siddique, A.; Mahapatra, A.K.; Morgan, E.R.; Pech-Cervantes, A.A.; Van Wyk, J.A. https://doi.org/10.3390/agriculture14050696

Objective: The primary aim of this research is to advance and extensively implement a centralized, mobile-phone-based automated decision support system (aDSS) for promoting sustainable animal health management and the production of anti-parasitic tannin-rich forage, in this way ultimately to contribute to the economic growth of R-P farmers and their communities

Procedures: The SSFMDSS automated model was used with geospatial data acquired to assess the spatial suitability of the study area for optimal SL production, and processed raster images were analyzed. Soil, land cover, and slope raster images were utilized. Each of the three raster datasets mentioned was individually reclassified to assess suitability for SL production and reclassified rasters were integrated using the "Weighted Sum" tool within ArcGIS Pro 3.2. A prototype RFID system designed for remote monitoring and communication of individual animal activity levels, thereby assessing the grazing behavior of sheep on commercial farms and the performance of the system was assessed against various animal behaviors and disease states, with a particular focus on debilitating helminth infections. Data collected over several years (2013–2014) for both healthy and known sick animals to determine transponder signal range values associated with various behaviors.

Results: An automated geospatial model for precision agriculture (PA) can identify suitable locations for its cultivation. Additionally, a novel approach of radio-frequency identifier (RFID) supported telemetry technology can track animal movement, and the analyses of data using artificial intelligence can determine sickness of small ruminants. This RFID-based system is being connected to a smartphone app (under construction) to alert farmers of potential livestock health issues in real time so they can take immediate corrective measures. An accompanying Decision Support System (DSS) site is being developed for R-P farmers to obtain all possible support on livestock production, including the designed PA and RFID-based DSS.

Impact: Farmers will be able to use the process established to identify the most favorable sites for growing seriecea lespedeza, enhancing the nutrition and health of their livestock. Furthermore, the radio-frequency identification (RFID) system provided a method for monitoring animal health and detecting behaviors associated with predator attacks or poaching incidents on producer farms.

Innovations in animal health: artificial intelligence-enhanced hematocrit analysis for rapid anemia detection in small ruminants. Siddique A, Panda SS, Khan S, Dargan ST, Lewis S, Carter I, Van Wyk JA, Mahapatra AK, Morgan ER and Terrill TH.
https:///doi.org/10.3389/fvets.2024.1493403

Objective: The objective of this study was to assess the packed cell volume (PCV) levels in blood samples from small ruminants, specifically goats, and create an efficient biosensor for more convenient, yet accurate detection of anemia for on-farm use in agricultural environments for animal production optimization.

Procedures: The study encompassed 75 adult male Spanish goats, which underwent PCV testing to ascertain their PCV ranges and their association with anemic conditions. Using artificial intelligence-powered machine learning algorithms, an advanced, easy-to-use sensor was developed for rapidly alerting farmers as to low red blood cell count of their animals in this way to enable timely medical intervention. The developed sensor utilizes a semi-invasive technique that requires only a small blood sample. More precisely, a volume of 30 μL of blood was placed
onto Whatman filter paper No. 1, previously soaked with anhydrous glycerol. The blood dispersion pattern on the glycerol-infused paper was then recorded using a smartphone after 180 s. Subsequently, these images were examined in correlation with established PCV values obtained from conventional PCV analysis. Four separate machine learning models (ML) supported models, namely support vector machine (SVM), K-nearest neighbors (KNN), backpropagation neural network (BPNN), and image classification-based Keras model, were created and assessed

using the image dataset. The dataset consisted of 1,054 images that were divided into training, testing, and validation sets in a 70:20:10 ratios.

Results: The initial findings indicated a detection accuracy of 76.06% after only 10 epochs for recognizing different levels of PCV in relation to anemia, ranging from healthy to severely anemic. This testing accuracy increased markedly, to 95.8% after 100 epochs and other model parameter optimization. Results for SVM had an overall F1 score of 74–100% in identifying the PCV range for blood pattern images representing healthy to severely anemic animals, and BPNN showed 91–100% accuracy in identifying the PCV range for anemia detection.

Impact: This work demonstrates that AI-driven biosensors can be used for on-site rapid anemia detection. Optimized machine learning models maximize detection accuracy, proving the sensor's validity and rapidity in assessing anemia levels. This breakthrough will allow farmers, with rapid results, to increase animal wellbeing and agricultural productivity.

Smartphone integration in anemia detection for small ruminants with Convolutional Neural Networks. Randall RJ, Pech-Cervantes A, van Wyk J, Panda S, Mahapatra A, Morgan E, Stegall K, Brown D, Manns E, Saunders S, villa AR, Plummer A, Terrill TH.
https://doi.org/10.1093/jas/skae019.036
Objective: Anemia, often caused by internal parasites like Haemonchus contortus, presents significant health and productivity challenges for small ruminants. The primary goal of this study was to accurately distinguish between healthy and anemic goats using an image classification system focused on eye conjunctiva images.

Procedures: Over 5,000 eye conjunctiva images from 75 goats were collected at Fort Valley State University farms over a 3-mo period using smartphone cameras. These images were randomly divided into training (70%) and testing (30%) datasets, with each group containing five subfolders corresponding to FAMACHA scores of 1, 2, 3, 4, and 5. A Convolutional Neural Network (CNN) algorithm was utilized for image analysis, incorporating data augmentation techniques such as Resize, RandomHorizontalFlip, RandomVerticalFlip, and RandomRotation. The CNN model was built on the Google Colaboratory platform using CUDA 11.2 and the PyTorch machine learning framework, incorporating three ConvNet layers. The model training used the Adam Optimizer with a slower learning rate of 0.001 and a weight decay of 0.0001 to prevent exploding gradient issues, alongside ReLU and the cross-entropy loss function over 1000 epochs.

Results: Results demonstrate that the CNN model was highly effective in classifying eye conjunctiva images of goats to detect anemia based on FAMACHA scores.

Impact: Use of a smartphone may help to reduce the subjectivity of FAMACHA scoring and reduce the need for FAMACHA training in remote areas.

Langston University

Evaluate on farm use of Duddingtonia flagrans (Livamol® with BioWorma®) and COWP in controlling *Haemonchus contortus* in grazing dairy goats

Authors: R. C. Merkel, Z. Wang, A. O. Sonibare, T. A. Gipson, and A. Manley

Objective:
Duddingtonia flagrans is a nematode-trapping fungi that can be fed to animals and that passes through the animal intact and is deposited in the feces where it entraps and consumes the larval stages of roundworms thereby reducing the number of infective larvae on pasture. This fungus can be fed to grazing animals through a product called Livamol® with BioWorma® (LB).

Burke et al. (2005) administered COWP and(or) fed *D. flagrans* to 4-mo old Katahdin and Dorper lambs in a 35-day trial evaluating potential negative effects on COWP to *D. flagrans*. FEC was reduced in lambs with COWP and *D. flagrans*-fed lambs on day 7 and 14 although FEC of the latter group was similar to that of lambs not given COWP after day 21 of the trial. Cultured larvae from feces were lower in *D. flagrans*-fed lambs than lambs not receiving the fungal spores and were lowest in lambs fed *D. flagrans* that had been given COWP. No negative effect of COWP on *D. flagrans* was found.

However, in previous trials at Langston University and on producer farms, conflicting results were found. In one instance, the combination of COWP and LB was one of the poorer treatment combinations. The objective of this trial was to evaluate potential synergistic effects of *Duddingtonia flagrans* (Livamol® with BioWorma®) and COWP in controlling *Haemonchus contortus* fed to grazing dairy goats.

Procedure: The 90-day trial was conducted on the farm of a dairy goat producer who raises a mixture of dairy goat breeds including Alpine and Nubian. The trial utilized two groups of dairy doelings and wethers, 12 to 15 per group. Both groups received a 2g COWP bolus on day 1 of the trial (COWP treatment) with one group also fed LB daily (LB treatment). Both groups received an equal amount of supplemental feed. The two groups were housed and grazed in separate pastures with free choice access to water and mineral and will have access to shelter. Fecal egg count (FEC), FAMACHA, packed cell volume (PCV), body condition score (BCS), and body weight (BW) were taken every 30 days. Along with the FEC, larval cultures were prepared per treatment group to determine the treatment effects on infective larvae (L_3) number and the L_3 larvae were identified.

Statistical Analysis
Sample data were analyzed using repeated measures method in R (Luke, 2016). The statistical model was:
$y = X\beta + Zu + e$
where, y is the vector of dependent variables (BW, BCS, FAMACHA, PCV, or FEC); X is the incidence matrix of fixed effects, β is the vector of fixed effects e.g. date, and treatments (COWP or LB), Z is the incidence matrix of random effects, u is the vector of animal IDs on which repeated measure are taken, and e is the vector of random errors. Least-square means (lsmeans) are presented in Table 1. BCS and FAMACHA tested for independence using a row-by-column chi-square and

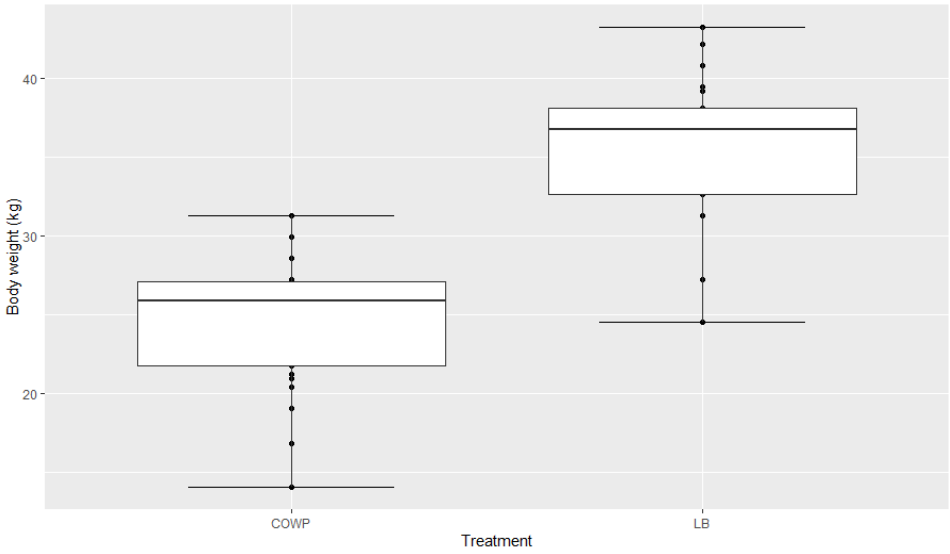
then transformed for lsmean analysis. PCV was normalized using the arcsine transformation (Chauhan et al., 2003) and FEC was normalized natural logarithm transformation (Mandall et al., 2008). Untransformed lsmeans are presented in the table for PCV and FEC.

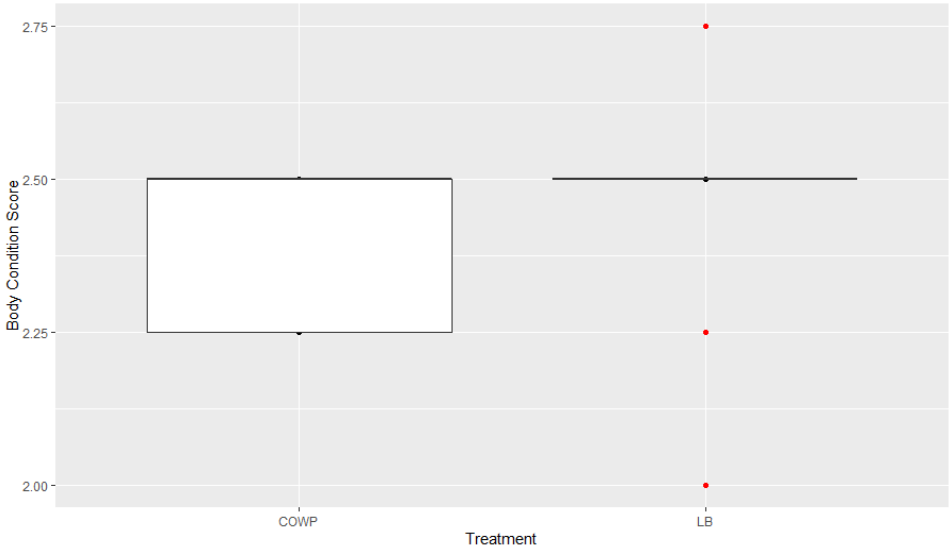
Larval culture data were analyzed as a split-plot in time.

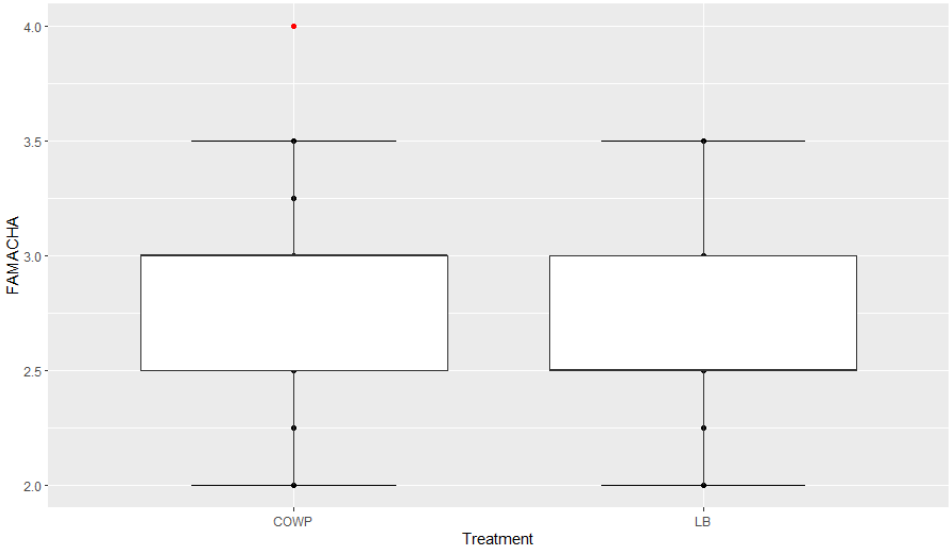
RESULTS AND DISCUSSION

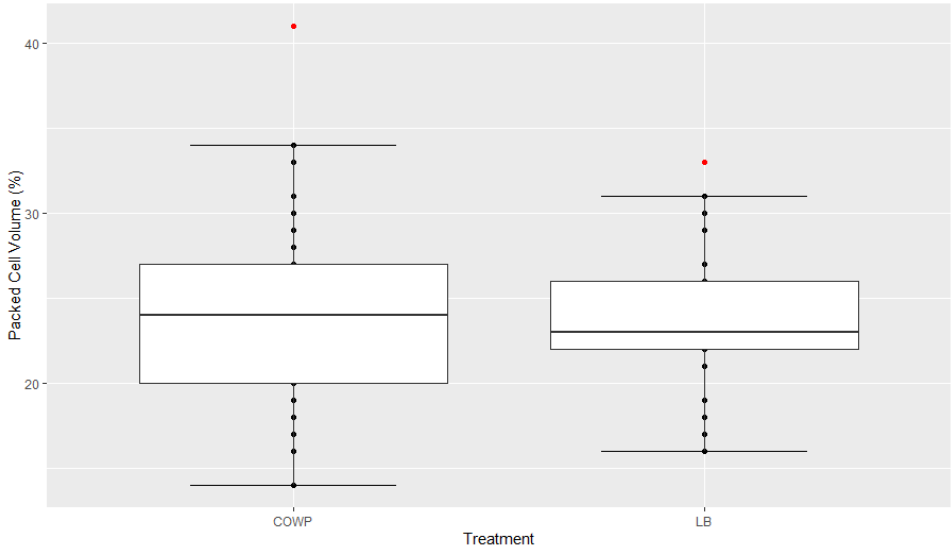
Data are displayed graphically in the boxplots below. In the boxplots, COWP refers to goats that only received the bolus whereas LB refers to goats that received the combination of a COWP bolus plus feeding LB daily.

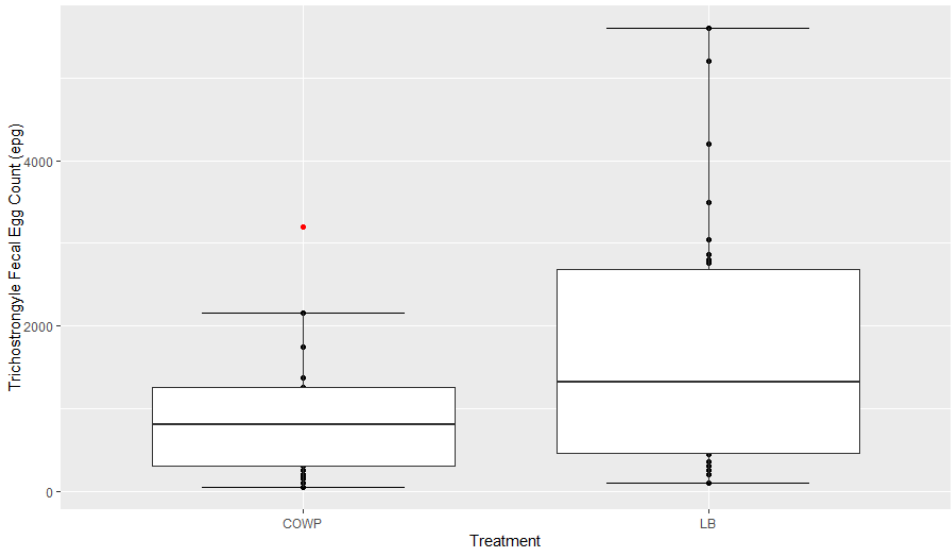
Impact: Body weight and body condition scores were significantly higher ($p<0.01$) for LB than for COWP over the experiment. FAMACHA scores were lower ($p<0.05$) for LB than COWP, which is a favorable direction; however, PCV did not reveal a difference between the two treatments ($p>0.10$). Trichostrongyle fecal egg counts were higher ($p<0.01$) for LB than for COWP; however, *Haemonchus contortus* larval count were similar ($p>0.10$) for the two treatments as was the ratio of lpg to epg. These results do not support the cost and labor of feeding LB daily, agreeing with previous trials done at Langston University. Further topics for research include a longer period of feeding LB to goats and looking at the number of infective larvae residing on pasture forage, not just those that hatch from feces.

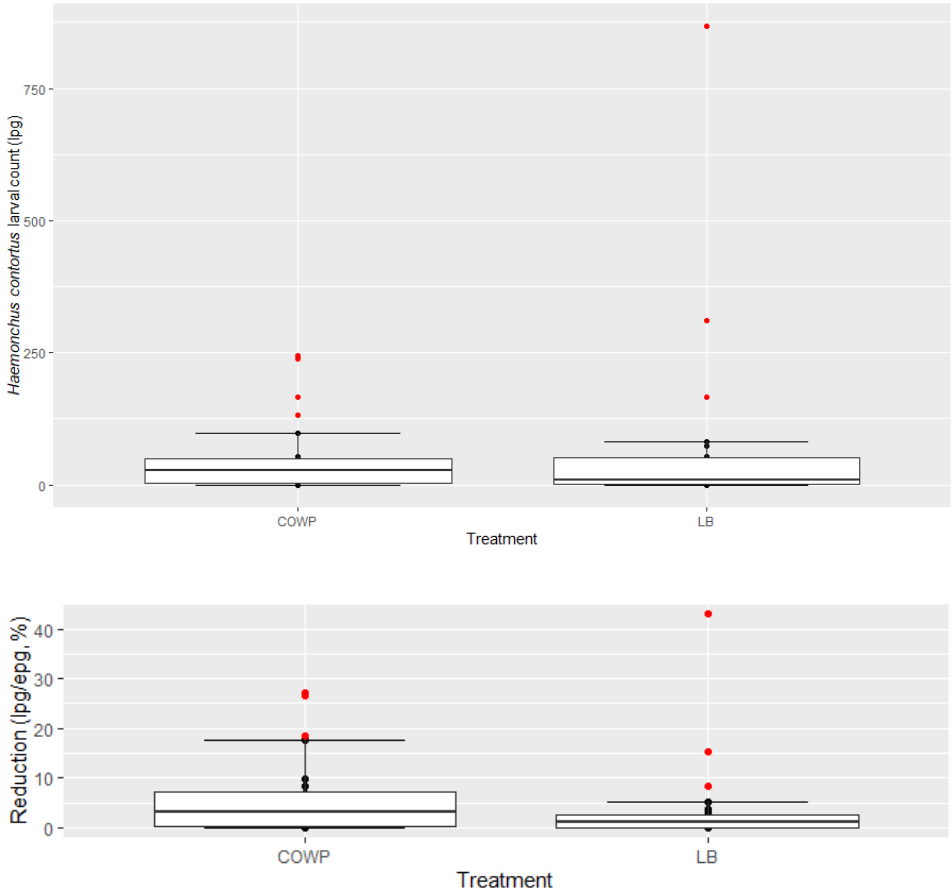



2.75
2.50
2.25
2.00
Body Condition Score
COWP
LB
Treatment


4.0
3.5
3.0
2.5
2.0
FAMACHA
COWP
LB
Treatment


40
30
20
Packed Cell Volume (%)
COWP
LB
Treatment


4000
2000
0
Trichostrongyle Fecal Egg Count (epg)
COWP
LB
Treatment



Trait	COWP	LB
Body weight (kg)	$24.7^{a} \pm 1.03$	$35.5^{b} \pm 1.03$
BCS	$2.41^{a} \pm 0.0214$	$2.49^{b} \pm 0.0214$
FAMACHA	$2.91^{a} \pm 0.0626$	$2.68^{b} \pm 0.0626$
Packed cell volume (%)	$23.8^{a} \pm 0.901$	$24.0^{a} \pm 0.901$
Trichostrongyle fecal egg count (epg)	$879^{a} \pm 228$	$1{,}807^{b} \pm 218$
Eimeria fecal oocyst count (opg)	$1282^{a} \pm 313$	$558^{a} \pm 323$
Haemonchus contortus larval count (lpg)	$52.1^{a} \pm 27.5$	$72.3^{a} \pm 27.5$
Trichostrongylus larval count (lpg)	$26.8^{a} \pm 4.65$	$26.8^{a} \pm 4.65$
Teladorsagia circumcincta larval count (lpg)	$24.9^{a} \pm 4.44$	$18.5^{a} \pm 4.44$
Haemonchus contortus reduction (lpg/epg, %)	$6.24^{a} \pm 1.65$	$3.90^{a} \pm 1.65$

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University of Maryland Eastern Shore

Objective: 1.- The UMES Small Ruminant Extension specialist conducts investigation on fescue toxicosis due to endophyte toxins.
2.- Continued use (10 years) of CIDR's to assist in sheep and goat estrus synchronization for optimal kidding/lambing management and enhancement of newborn survival.
3.- Sheep and goat producers are informed of the small ruminant farm operational plans via farm visits and workshops.

USDA, Agricultural Research Service, Booneville, AR

Objective 1: Utilization of gastrointestinal nematode (GIN) control methods including feeding *Duddingtonia flagrans*, forage/grazing management, and animal selection for GIN resistance

Effect of black walnut hull powder and sericea lespedeza on gastrointestinal parasites and systemic innate immune response activation in Katahdin lambs

Henrietta Owusu[1], Emmanuel Asiamah[1], Joan M. Burke[2], Suman Rohila[2], Maxwell Mkunga[1], James Muir[3], Nichole Cherry[3] ([1]University of Arkansas-Pine Bluff; [2]USDA, ARS, Booneville, AR; [3]Texas A&M, Stephenville, TX)

Objective: Sheep production faces significant economic losses due to prevalent parasitic and pathogenic diseases. To promote health through non-chemical approaches, the use of sericea lespedeza (SL; *Lespedeza cuneata*) supplementation in animal production has gained popularity for its potential to improve sustainability and reduce environmental impact. This study evaluated the effects of daily supplementation with black walnut hull powder (WH; *Juglans nigra*) compared to pelleted SL on immune modulation and overall health in Katahdin lambs. WH, a by-product of the walnut industry, is known for its antioxidant and anti-inflammatory properties, while SL, rich in condensed tannins and polyphenols, activates immune-related genes.

Procedure: Naturally infected Katahdin ewe and ram lambs (n = 30) were randomly assigned to one of three dietary treatments: Control (alfalfa pellets; CON), SL pellet, or CON supplemented with 1 g of WH powder, n=10/diet. Lambs were grazed on grass-based pastures, and an experimental diet was fed for 4 wk, followed by CON for an additional 2 wk. Blood samples (10 mL) were obtained on Days 0 (first day of dietary treatment), 14, 28 and 42 of the study to determine packed cell volume (PCV). Fecal samples (≥2 g) were collected weekly throughout the experiment to determine fecal egg (FEC) and oocyst counts (FOC) and at the same time, body weight and body condition scores were determined. Total RNA was isolated using Trizol followed by cDNA synthesis that was used to perform qRT-PCR of immune-related genes, including IL-1β, TNF, IL-8, NFKB1, TLR4, and IL-10. GAPDH and Beta-actin were used for normalization. Data was analyzed using mixed models and repeated measures over time (SAS).

Results: Both WH and SL tended to reduce FEC ($P < 0.10$) and SL reduced FOC ($P < 0.001$). SL-fed lambs were heaviest compared with CON and WH lambs ($P < 0.001$). Immune status was assessed using the D2DX™ Immunity Test, revealing no differences between treatment groups at Day 42; $P = 0.21$. Notably, gene expression analysis revealed significant upregulation of IL-1β (5.19-fold) and TNF (5.46-fold) on Day 28 and IL-8 (8.62-fold) on Day 14.

Impact: These findings suggest that WH and SL may enhance immune responses and improve parasite management in Katahdin lambs. Higher doses of WH are suggested though toxicity must be explored further.

Virginia State University

The Efficacy of a Natural Fungus (*Duddingtonia flagrans*) in Reducing Gastrointestinal Nematode Indicators in Lambs

Dahlia O'Brien, Stephan Wildeus, Kwame Matthews (Delaware State University)

Objectives: Production and animal losses due to gastrointestinal nematode (GIN) infection, especially by the blood sucking *Haemonchus contortus*, is a major constraint not only to profitability, but also to sustainability of U.S. small ruminant operations. In the absence of vaccines, the only mode of control of GIN is the use of anthelmintics/dewormers. However, decades of relying on dewormer treatments for parasite control has led to the emergence of multi-drug resistant parasites which pose a significant challenge to effective control on small ruminant farms world-wide. An alternative method to dewormers that has been proven to effectively control internal parasites is the nematode trapping fungus, *Duddingtonia flagrans*. The effectiveness of a natural fungus (*Duddingtonia flagrans*; Livamol with Bioworma®, International Animal Health) in reducing gastrointestinal nematode infection in hair sheep wethers was evaluated in this study.

Procedure: Eighteen 8-month old St. Croix and Barbados Blackbelly wethers were dewormed and separated into two treatment groups (n = 9/group), split into 3 replications per treatment and placed on six pasture paddocks (0.06 ha; n = 3 per paddock) after accounting for breed and body weight (BW). Lambs were then fed daily either a grain supplement ration (corn and soybean meal) with Livamol with Bioworma® (LIV) or without (CON) at 1% of their BW. LIV was added to the ration based on total lamb BW/paddock. Bodyweight and body condition scores (BCS) were recorded every 2 weeks for 128 days and blood and fecal samples were also collected for determination of packed cell volume (PCV) and FEC. Pooled treatment group feces were collected and cultured to determine GIN genera. Data were analyzed using repeated measures in a mixed model, and FEC were log transformed prior to analysis.

Results: Following deworming (d 0), FEC were reduced by 100% by d 14. There was a mixed population of GIN at the start of the study. LIV with Bioworma® supplementation had no impact on BW, BCS, PCV or FEC in this study averaging 24.1 ± 0.4 kg, 2.2 ± 0.03, 31.0 ± 0.3% and 205.4 ± 18.2 eggs per gram, respectively.

Impact: Under the conditions of this study, the supplementation of *Duddingtonia flagrans* did not have any significant effect on internal parasite indicators measured.

The influence of supplementation type and mating season on parasite indicators in hair sheep ewes during late gestation

Dahlia O'Brien, Stephan Wildeus, Kwame Matthews (Delaware State University), Niki Whitley (Fort Valley State University)

Objectives: Adequate supplementation during late gestation and lactation has been shown to reduce impacts of the temporary loss in immunity caused by increased gastrointestinal nematode (GIN) parasitism pre- and up to 8 weeks post-lambing in ewes. This study evaluated effects of supplementing soyhulls (SH) on GIN infection parameters in hair sheep ewes mated in November, March and July.

Procedure: Pregnant ewes mated in November, March and July. Pregnant ewes (n=30-36) were allocated, balanced by breed, parity and fetal numbers, to either corn/soybean (CS) or SH supplementation during the last trimester of pregnancy. Ewes rotationally grazed predominantly fescue pastures subdivided into 6 sections (0.13 ha with 3 sections of 5-6 ewes/supplement type) and were supplemented at either 0.75% BW (late gestation) or 1.5% BW (lactation) using a single feeder per section. Ewes lambed on pasture and nursed lambs for 63 d. Blood and fecal samples were collected pre- (PRE), and post-partum (PP) and at weaning (WEAN) for determination of packed cell volume (PCV) and FEC. Pooled treatment group feces were also collected and cultured to determine GIN genera. Body condition scores (BCS) were also recorded at each sampling. Data was analyzed with supplement type and mating season as the main effects and FEC were log transformed prior to analysis (means reported).

Results: *Haemonchus contortus* (53.9%) was the most common GIN throughout the study. Although there was no effect of diet or season on PRE-FEC (overall mean 198±35 epg), there tended ($P=0.0643$) to be an effect of season on PRE-BCS with the lowest scores in March (2.3±0.09 vs 2.6±0.09 for July and November), and there was an effect of season ($P<0.0001$) on PRE-PCV with March the lowest (29.1±0.6%) and November the highest (38.3±0.7%; July=32.0±0.7%). There was an effect ($P<0.02$) of season on PP-BCS (March lowest at 2.0±0.08, others similar at 2.4±0.09 for July and 2.3±0.08 for November) and PP-FEC (July lowest at 135±122 epg, similar to November at 321±111 epg, March highest at 761±111 epg, $P<0.0001$). The PP-PCV was impacted by a diet x season effect ($P<0.04$) in which CS was higher ($P<0.02$) than SH for July only (36.1±0.7% and 32.4±0.7%, respectively). Weaning BCS tended ($P=0.067$) to be higher for CS (2.0±0.08) than SH (1.7±0.08). Weaning PCV was also impacted by a diet x season effect ($P<0.001$) in which CS tended ($P=0.0567$) to be higher in March (29.1±0.7% vs 27.1±0.8%) and was higher ($P<0.04$) in November (33.1±0.7% vs 30.8±0.7%) than for SH. Weaning FEC was not influenced by diet or season (overall mean 273±32 epg).

Impact: Under similar conditions, SH could serve as an adequate supplement for ewes pre- and immediately post-lambing, though body condition score and packed cell volume should be monitored closely if used as the only supplement during lactation.

Objective 2: Emphasis of forage feeding systems for year-round grazing to meet nutritional requirements that mitigate drought and other plant and animal stressors.

Virginia State University

Evaluating soy hull as a supplement during late gestation and lactation in landrace hair sheep managed under accelerated mating in a forage-based system

Stephan Wildeus, Dahlia. O'Brien, Jung Lee (Fort Valley State University) and Niki Whitley (Fort Valley State University)

Objectives: Forage-based production systems can be limited by seasonal fluctuations in forage quality and quantity. This study evaluated the use of agro-byproduct (soy hull) supplementation to fill increased nutritional demands during late gestation and lactation in Barbados Blackbelly (BB) and St. Croix (STX) hair sheep ewes managed under accelerated mating in a forage-based system.

Procedure: Ewes were bred in March, July, and November in 25-d breeding seasons in two single-sire groups to like breed sires, and subsequently managed as one group. Pregnant ewes (30-36 per season) were allocated balanced by breed, parity and fetal numbers to either corn/soybean meal or soy hull supplementation starting the last trimester. Ewes rotationally grazed or were provided hay on pastures divided into 6 sections (0.13 ha; 3 sections of 5 - 6 ewes per supplement type). Ewes were supplemented at either 0.75% BW (gestation) or 1.5% BW (lactation) in a single feeder per section. Ewes lambed on pasture and lambs were weaned at 63 d. Data were collected on ewe BW changes and reproductive performance. Data were analyzed in a model with supplement type, mating season, and breed as main effects, and values are presented as least squares means.

Results: Supplement type had no effect of ewe BW at any stage of production, daily gain during late gestation or lactation, litter size at birth and weaning, and litter ADG, regardless of breed or mating season. In contrast, mating season affected prepartum and weaning ewe BW, being higher ($P<0.05$) following November (54 and 44 kg) than March mating (49 and 41 kg), respectively, with July (53 and 44 kg) being intermediate. Late gestation ADG differed ($P< 0.001$) in all seasons, being highest following July mating (117 g/d), intermediate in November (63 g/d) and lowest in March (-4 g/d). Lactation ADG was again lower ($P<0.05$) following March mating (-79 g/d), than July (-33 g/d) and November (-46 g/d). Litter birth weight was higher ($P<0.01$) following November mating (6.1 kg) than July (5.3 kg) and March (5.1 kg) mating, but season did not affect litter weaning weight or litter ADG. Similarly, litter size at birth was higher ($P<0.05$) following November mating (2.1) than in July (1.7) and March (1.7), but not different between seasons at weaning. Body weight and condition was higher ($P<0.001$) in STX than BB at all stages of the production cycle, however, neither gestation and litter ADG nor litter size were different between breeds. There were significant ($P<0.05$) breed x season interactions for ewe weaning weight, lactation ADG and litter birth weight, with seasons differing ($P<0.05$) for STX, but not BB.

Impact: Findings indicate that soy hull can replace corn-based supplementation in landrace hair sheep without negatively impacting production under the forage environment evaluated here.

Effect of supplement type and season on pre-weaning lamb performance in landrace hair sheep in a pasture-based accelerated mating system.

Stephan Wildeus, Dahlia O'Brien

Objectives: Pasture-based sheep production may require supplementation during periods of reduced forage quality and quantity, and periods of high nutritional demands. This experiment compared the use soy hull supplementation with a more traditional corn-based supplement for hair sheep ewes managed on pasture-based accelerated mating system. More specifically, the growth performance and fitness of the lambs was evaluated.

Procedure: Ewes (Barbados Blackbelly and St. Croix; 30 -36 per season) were bred in March, July, and November in 25-d breeding seasons in two single-sire groups to like breed sires, and subsequently managed as one group. Pregnant ewes (30-36 per season) were allocated balanced by breed, parity and fetal numbers to either corn/soybean meal (CS) or soy hull (SH) supplementation starting the last trimester. Ewes were supplemented at either 0.75% BW (gestation) or 1.5% BW (lactation) in a single feeder per section. Ewes rotationally grazed or were provided hay on pastures divided into 6 sections (0.13 ha; 3 sections of 5 - 6 ewes per supplement type). Ewes lambed on pasture. Lambs had access to the supplement provided to their dams and were weaned around 63 d. Lamb birth and weaning weights were recorded, and fitness fecal egg counts (FEC), packed cell volume (PCV), and body condition (BC) were determined at weaning. Data (n=175) were analyzed in a model with supplement type, mating season, breed, sex, and birth type as main effects.

Results: Lambs with access to the CS tended ($P<0.1$) to have a higher 60-d adjusted weaning weight (11.8 vs. 11.5 kg), pre-weaning ADG (148 vs. 135 g/d), BC (1.82 vs. 1.64) compared to SH lambs. There was no effect of supplement type on FEC and PCV. Mating season had a significant effect on lamb weaning weight and pre-weaning growth and ADG was higher ($P<0.001$) in April-born (155 g/d) compared to December-born lambs (126 g/d), with August-born lambs being intermediate (144 g/d). There was a supplement type x season interaction ($P<0.05$) for weaning weight and ADG with lower growth performance in SH-supplemented lambs in July, and increased growth in CS-supplemented lambs in November. Lamb survival to weaning tended ($P=0.08$) to be higher in SH-supplemented (92.1%) than CS-supplemented (83.7%) lambs. There was no effect of season on BC, FEC, and PCV. St. Croix lambs had higher ($P<0.05$) birth and weaning weights, but not ADG than Barbados Blackbelly lambs, and lower PCV ($P<<0.05$). Male lambs were heavier ($P<0.01$) at birth and weaning, and had higher ($P<0.05$) ADG, with no sex difference in PCV and FEC. Single lambs were heavier and grew faster and had higher BC and PCV than twins ($P<0.001$), which were higher ($P<0.001$) than triplets. Survival to weaning was higher ($P<0.05$) in single (96.1%) and twin (90.8%) than triplets (70.0%). There was no effect breed type on fecal egg count.

Impact: Soy hull supplementation caused a nominal reduction pre-weaning growth of lambs, but also a moderate improvement in lamb survival. A season by supplement type interaction suggests an influence of forage environment on the supplementation response.

Impact of soy hull supplementation on performance of ewes and their lambs in a pasture-based production system following fall mating

Stephan Wildeus, Dahlia O'Brien

Objectives: While pasture-based production systems most effectively address the need for increased sustainability, they may not always satisfy elevated nutritional requirements associated with certain stages of production. This project evaluated the use soy hull supplementation during late gestation lactation and gestation in a pasture-based production system for landrace hair sheep.

Procedure: Following a November mating, confirmed pregnant ewes (n=30) equally representing Barbados Blackbelly and St. Croix were assigned balanced by breed and parity following to receive soy hull supplementation or continue on pasture only at the beginning of the third trimester. Ewes rotationally grazed or were provided hay on pastures divided into 6 sections (0.13 ha; 3 sections of 5 - 6 ewes per supplement type). Ewes were supplemented at either 0.75% BW (gestation) or 1.5% BW (lactation) in a single feeder per section. Ewes lambed on pasture and lambs were weaned around 63 d. Lambs had access to the supplement provided to the ewes. Data were collected on body weight changes (ewes and lambs), lambing performance (ewes) and indicators of gastrointestinal parasites (ewes and lambs). Ewe data was analyzed in a model with diet (pasture-only vs. soyhull supplementation), breed as main effects, while the model for lambs also included sex and birth type. Data for fecal egg count was analyzed after log transformation.

Results: There was no effect of supplementation on ewe pre- and postpartum weight change, but soy hull supplementation significantly improved late gestation daily gain (77 vs.144 g/d; $P<0.05$), and reduced lactation weight loss (-117 vs. -72 g/d; $P<0.01$). Supplementation also tended to improve body condition at weaning ($P<0.1$). Supplementation had no effect on lambing performance (litter birth and weaning weight, and lamb survival to weaning), nor indicators of gastrointestinal parasitism (fecal egg count, packed cell volume). Lambs from ewes supplemented during lactation and having access to the supplement pre-weaning had higher weaning weights (11.5 vs. 13 kg; $P<0.05$), higher packed cell volume (28.9 vs. 34.2%; $P<0.1$), and lower fecal egg counts (2263 vs.1051 eggs/g; $P<0.05$). There also was a diet by breed interaction for packed cell volume ($P<0.01$) and fecal egg count ($P<0.05$) with a reduced PCV and increased egg count in Barbados Blackbelly lambs on pasture-only compared to supplementation, while diet had no effect in St. Croix lambs.

Impact: Findings indicate that supplementation had no immediate impact on lambing performance in pasture-reared ewes, but negatively impacted body weight change and may result in a reduced lifetime production, especially under accelerated mating. The absence of supplementation resulted in reduced lamb weaning weights and increased susceptibility to gastrointestinal parasitism, and may also be influenced by breed type.

Effects of harvest weight on carcass traits of forage-raised landrace hair sheep lambs

Davida Rimm-Kaufman, Jung Lee (Fort Valley State University, Dahlia O'Brien and Stephan Wildeus

Objectives: Non-traditional lamb markets are growing, especially in the Mid-Atlantic States. These markets demand animals with lower finishing weights than commodity lambs and cater mostly to ethnic communities. This study compared carcass traits of wethers harvested at three target weights.

Procedure: Barbados Blackbelly (BB) and St. Croix (SC) lambs were born on pasture in July, weaned at 9 weeks, transitioned in dry-lot pens for 2 months, and then grazed on pasture with soy hull supplementation at 3% body weight. Animals were weighed weekly and harvested by industry-accepted practices as they reached their designated weight. Twelve wethers per breed were harvested at 3 breed specific target weights: high (H), medium (M) and low (L), based on the projected breed yearling weight (BB: 43, 39, and 34 kg; SC: 48, 43 and 39 kg). The ranges for the 3 target weights were 42.2-42.4 kg, 37.2-38.5 kg and 33.4-34.9 kg for BB, and 46.7-47.6 kg, 42.3-44.4 kg, and 39.6-40.3 kg for SC. Standard carcass data was collected. Data was analyzed with target weight and breed as the main effects.

Results: SC lambs were heavier ($P<0.05$) than BB lambs at birth and at weaning, and despite higher target weights, age at harvest was lower ($P<0.05$) for SC (329±8.0 d) than for BB lambs 360±8.0). Dressing percentage was not influenced by breed or target weight and averaged 50.8±0.5%. Kidney-pelvic fat was different ($P<0.001$) between the 3 target weights (1.10, 0.93, 0.56 g respectively), and the difference persisted after adjustment for CCW. Kidney-pelvic fat was also greater in SC than BB ($P<0.001$). Back fat was affected by target weight (0.43, 0.31, 0.20 cm, respectively, $P<0.001$), but was no longer present after CCW adjustment. Back fat was not affected by breed. Body wall thickness (1.52 cm) was not affected by target weight or breed. Leg circumference was affected by target weight (63.2, 61.9, 59.7 cm, respectively, $P<0.001$) and breed (60.6 and 62.6 for BB and SC respectively, $P<0.01$) and persisted when adjusted for CCW. Cooler shrink was different between target weights (2.7, 4.1, 5.0%, respectively, $P<.05$) but not affected by breed. BCTRC was affected by target weight (47.9, 48.6, 49.9%, respectively, $P<0.01$) and breed (49.5, 48.2 for BB and SC respectively, $P<0.01$). REA was not affected by target weight but was affected by breed (14.7 and 12.4 for BB and SC respectively, $P<0.001$), however, weight-adjusted REA was different ($P<0.0001$) for both target weight and breed.

Impact: In this preliminary study, only minimal effects of target weight on carcass characteristics were observed. This suggests that target weight should be considered when specialty markets are available.

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University of Arkansas

Project: Evaluation of Strategies to Mitigate Tall Fescue Toxicosis in Sheep
Ken Coffey, Christine Nieman (USDA/ARS), Dirk Philipp

Objective: Determine the impact of red clover extract on intake, digestibility, and other symptoms of tall fescue toxicosis

Procedures: Growing lambs were housed in individual pens with metal grate flooring for a feed intake and digestion study. Lambs were offered ad libitum access to diets of bermudagrass hay with either non-toxic fescue seed (E-) with no red clover extract, toxic fescue seed (E+) with no red clover extract, or E+ with 0.33%, 0.67% or 1.0% red clover extract.
Results: Digestibilities of dry matter, organic matter and fiber components were not different among treatments. However, digestible dry matter and organic matter intakes were greater by the lambs offered the non -toxic seed, and the red clover extract did not improve digestible intake by the lambs offered the toxic seed. The lambs offered the non-toxic seed also consumed and retained more nitrogen than the lambs offered the toxic seed, regardless of the level of red clover extract added. Lambs offered the E+ diet with 1% RCE excreted a greater proportion of the total N excretion in the urine compared with those offered the non-toxic diet. Therefore, forage toxicity, but not the proportion of red clover extract in the diet, impacted intake, digestibility, and nitrogen-use efficiency.
Impact: Tall fescue toxicosis is a serious problem for livestock producers in the southeastern and lower midwestern US. Many different strategies have been tried in an attempt to reduce the problem, but to date, the different strategies have shown only limited to no effect. Others have shown that red clover extract can reduce vasoconstriction resulting from exposure to ergot alkaloids, but our study did not support those findings. Therefore, producers are still left with a few management strategies that have limited impact on tall fescue toxicosis.

Objective 3: Strategies for the improvement of small ruminant reproduction

Fort Valley State University

Impact of l-carnitine dietary supplementation on the quality of ram semen collected during the non-breeding season. Jordan J., Whitley N. C., Fareed J., Narlagiri R., Kolikapongu R., Odom T., Brown D., Ramsey T., Shahat A. M., Singh M., Kouakou B., Polejaeva I. A., Moawad A. R. https://doi.org/10.1071/RDv37n1Ab170

Objective: Ram spermatozoa are highly susceptible to oxidative damage mainly due to the high levels of polyunsaturated fatty acids in their plasma membranes and production of high amount of reactive oxygen species. l-Carnitine (LC) has potential impacts on sperm metabolism by supplying energy through β-oxidation to enhance sperm motility. LC is also critical for fatty acid metabolism and has antioxidant capacity. The objective was to evaluate the effects of LC dietary supplementation on the quality of ram semen collected during the non-breeding season.

Procedures: Ten mature Katahdin rams were randomly assigned into treatment (n = 5; fed LC added to a commercial sheep feed at 0.0022 g kg−1 of bodyweight), and control (n = 5, commercial sheep feed only) for 8 weeks during the non-breeding season (June–July). Semen was collected from the rams once per week by electroejaculation and then diluted with Tris buffer extender. Sperm cell concentration and motility were evaluated by CASA. Sperm viability was evaluated by eosin-nigrosin stain. Data were analyzed by independent t-test, and significant differences were set at $P < 0.05$.

Results: No significant differences ($P > 0.05$) were observed in sperm concentration (2.4 vs. 2.7 × 109 sperm mL−1), sperm motility (62.9% vs. 63.4%), or percentage of live spermatozoa (64.8% vs. 66.8%) between LC and control groups, respectively.

Impact: Under our experimental conditions, feeding rams with l carnitine during the non-breeding season had no significant impact on their semen quality compared with the control group.

Impacts of breeding method on metabolic profile, progesterone concentration, and pregnancy rates in dairy goats. Ramya Sri Kolikapongu, Sharath Chandra Namani, Miller Schauston, Mahipal Singh, Brou Kouakou, Adel R Moawad**.** https://doi.org/10.1093/jas/skae234.196

Objective: We previously reported that prostaglandin (PG)F2α alone could be used effectively for estrous synchronization in goats compared with PGF2α plus gonadotropin releasing hormone (GnRH). Our aim was to compare the breeding method (natural breeding vs. AI) on the metabolic profile, progesterone concentrations, and pregnancy outcomes of dairy goats.

Procedures: Mixed breed (Alpine and Saanen) mature does (n = 29; 3.9 ± 0.28 yr of age) were subjected to estrous synchronization by receiving two injections of 10 mg PGF2α on d 0 and d 11 per goat. Thirty-six hours after the second PGF2α injection, goats were either naturally bred (n = 14) with the same breed mature buck or artificially inseminated (n = 15) with frozen/thawed semen using cervical AI. Blood samples were collected on d 12 and 21 post-breeding (PB) for measuring cholesterol, glucose, and triglyceride concentrations. Furthermore, progesterone concentrations were

estimated on plasma samples collected on d 3, 9, 15, and 21 PB. Pregnancy specific protein B (PSB) concentrations were also detected on d 28, 35 and 42 PB. Data were analyzed by one-way analysis of variance, followed by post hoc Tukey's test.

Results: Results showed that, cholesterol concentrations on d 12 PB was greater ($P \leq 0.05$) in natural breeding than AI groups. However, no significant differences were observed in glucose and triglyceride concentrations between the 2 breeding methods. Progesterone concentration was greater ($P \leq 0.05$) on d 15 PB in natural breeding than AI groups. PSB was greater ($P \leq 0.05$) in natural breeding than AI groups at all time points. Pregnancy rates as detected by ultrasonography on d 50 PB were greater ($P \leq 0.05$) in natural breeding than AI groups (71.4% vs. 13.3%, respectively). Furthermore, the kidding rates were greater in natural breeding than AI groups (128.6% vs. 20.0%, respectively). The percentage of female kids was greater than male (66.6% vs. 33.3%, respectively) in both breeding methods.

Impact: In conclusion, our findings suggest that PGF2α alone as an estrous synchronization protocol combined with natural breeding was more effective than the use of AI after estrous synchronization under the conditions of this study.

Coenzyme Q10 supplementation enhanced dairy goat sperm motility, viability, and acrosome integrity after cooling and cryopreservation. Moawad A. R., Narlagiri R., Kolikapongu R., Henry C., Miller S., Kouakou B., Singh M., Shahat A. M., Whitley N. C., Polejaeva I. A. https://doi.org/10.1071/RDv37n1Ab40

Objective: Spermatozoa experience various types of damage during cryopreservation that negatively affects their fertilizing ability, primarily due to production of reactive oxygen species (ROS). Previous studies showed that supplementing extender with coenzyme Q10 (CoQ10), a vital component of the mitochondrial respiratory chain, could improve the fertility of frozen/thawed spermatozoa in various domestic animals; however, little is known about its impacts on goat semen. The objective was to evaluate the impact of CoQ10 supplementation on the quality of dairy goat spermatozoa after cooling or cryopreservation.

Procedures: Semen collected from six mature Alpine bucks twice per week using electroejaculation was diluted to a concentration of 800 × 106 sperm mL−1 in AndroMed extender (Minitube) supplemented with different concentrations of CoQ10 (0, 1, 2, 5, 10, and 20 μM). Diluted semen was either cooled at 4°C for 72 h or cryopreserved. For cryopreservation, semen was equilibrated for 3 h at 4°C and then loaded into 0.25-mm French straws. Straws were then placed 4 cm above liquid N2 vapor for 10 min before being submerged in liquid N2 for a week (Morrell et al. 2022 Animals 12, 352). Semen was thawed at 37°C for 30 s. Sperm motility (using CASA), viability (using eosin-nigrosin stain), membrane integrity (by hypo-osmotic swelling; HOS test), and acrosome status (with FITC/PNA stain) were evaluated at 24, 48, and 72 h post-cooling and post-thawing. Data were analyzed by one-way ANOVA.

Results: The results showed that in cooled semen, sperm motility, percentage of viable sperm, membrane integrity (% of HOS+ sperm), and percentage of sperm with intact acrosome were decreased in a time-dependent manner with the lowest values at 72 h postcooling. However, supplementing semen extender with 5 μM CoQ10 improved ($P \leq 0.05$) these parameters at all time

points compared with other CoQ10 concentrations. In frozen/thawed semen, sperm motility (46.7 ± 2.7%), percentage of live sperm (49.7 ± 0.5%), percentage HOS+ sperm (47.0 ± 0.9%), and percentage of sperm with intact acrosome (59.7 ± 0.5%) were higher ($P \leq 0.05$) in the group supplemented with 2 µM CoQ10 compared with the other CoQ10-supplemented groups. In conclusion, supplementing semen extender with either 2 µM or 5 µM CoQ10 significantly improved the quality of cooled or frozen/thawed goat spermatozoa, respectively.

Impact: These findings suggest the positive impact of CoQ10 in protecting dairy goat spermatozoa against cooling and freezing damage, offering an opportunity to improve the quality of cryopreserved goat semen for future use.

Effect of coenzyme Q10 supplementation on bovine oocyte maturation and embryo development. Beal D., Watkins L., Williams M., Liu Y., Blocher R., Patrick T., Bunderson I., Moawad A. R., Polejaeva I. A. https://doi.org/10.1071/RDv37n1Ab200

Objective: Coenzyme Q10 (CoQ10) is an essential carrier in the mitochondrial electron transport chain and has been used in vitro to improve mitochondrial function. CoQ10 has improved bovine IVM during heat stress and oocyte and embryo functions in vitro and in vivo under stress (Gendelman and Roth 2012 Biol. Reprod. 87, 118). Our aim was to determine the effects of CoQ10 supplementation at 25 µM, 50 µM, and 100 µM in bovine IVM medium on oocyte maturation and quality, mitochondrial mass, and subsequent development after parthenogenetic activation (PA).

Procedures: Cumulus-oocyte complexes (COCs) collected from abattoir-derived bovine ovaries were matured for 21–23 h in IVM medium supplemented with 25 mM, 50 mM, or 100 mM CoQ10 or without CoQ10 (control). Following maturation, COCs were denuded to assess the maturation rate. In Exp. 1, MII oocytes were stained with GSH and ROS as indicators of oocyte quality (five replicates), and MitoTracker Green was used to determine the mitochondrial mass in the oocytes (four replicates). The fluorescence intensity was analyzed by ImageJ. In Exp. 2, for PA, matured oocytes from each group were activated in 5 µM ionomycin for 5 min, followed by 4 h incubation in 2 mM 6-dimethylaminopurine and 10 µg mL−1 cycloheximide. PA embryos were cultured in SOF in four-well dishes under oil. Cleavage and blastocyst rates were assessed on Days 2 and 8 post-activation, respectively. Blastocyst rate was calculated as the number of blastocysts out of cleaved embryos. Fluorescence intensity data were analyzed by generalized linear model and embryo development data were analyzed by one-way ANOVA. Differences were deemed significant if $P < 0.05$. Results were presented as mean ± standard deviation. In total, 1293 COCs were collected in this study (334 for control, 318 for 25 mM, 332 for 50 mM, and 309 for 100 mM). After IVM, 326 MII oocytes were used for PA (three replicates), 88 oocytes for GSH staining, 95 oocytes for ROS staining, and 69 oocytes for MitoTracker staining. There were no differences in maturation rates among the groups (control, 62.7 ± 19.5%; 25 mM, 71.4 ± 7.0%; 50 mM, 74.0 ± 6.6%; 100 mM, 69.1 ± 10.2%; $P > 0.05$).

Results: Although no differences were observed in the relative levels of GSH and ROS among the groups, the mitochondrial mass in the 100 mM CoQ10 group was higher than in the control and 25 mM CoQ10 groups (1.92 vs. 1.00 and 0.86, respectively; $P < 0.05$). No differences were observed in the blastocyst rates of PA embryos among the groups; whereas, the cleavage rate in the 100 µM CoQ10 group was lower than in the control and 50 mM CoQ10 groups (73.2 ± 5.6% vs. 85.3 ± 4.1% and 88.7 ± 3.2%, respectively; $P < 0.05$).

Impact: In conclusion, lower concentrations of CoQ10 supplementation do not affect oocyte maturation and quality or embryo development, whereas a higher concentration of CoQ10 (100 mM) increases mitochondrial mass in bovine oocytes and decreases their cleavage rate after parthenogenetic activation. This offers a possible opportunity to improve embryo quality during use of reproductive technologies for livestock production.

Langston University

A comparison of Vaginal Deposition of Fresh Semen (Splashing) and Natural Service in CIDR/prostaglandin synchronized Goats

Authors: A. Ghnenis, G. Dinegdie, L. Dawson, and R. Merkel.

Objective:
There is a growing demand for small ruminant production, especially goats, for meat and milk to feed the ever-increasing human population. The artificial insemination (AI) industry for breeding goats using thawed, frozen semen is based on transcervical or laparoscopic-aided intrauterine insemination. These methods have become unsustainable due to cost and technological challenges for small ruminant producers. This project aimed to evaluate splashing (vaginal insemination) as a simplified technique for AI between two breeds of goats (Kiko and Spanish). The objectives were to compare the pregnancy success rate and kidding rates of splashing to natural mating between Kiko and Spanish does.

Procedure: Kiko (n=3) and Spanish (n=5) bucks were screened for breeding soundness prior to the trial. Semen used in the trial was collected using an artificial vagina. After semen collection, semen was diluted (1:1) using Andromed® extender and analyzed using an iSperm mCASA. Semen was diluted further for final adjustment to motile spermatozoa total contents, 200M/ml and immediately used for AI. Does, Kiko (n=20) and Spanish (n=20), underwent estrus synchronization using a controlled internal drug release (CIDR) vaginal device inserted on day 0. On day 10, 10 mg of PGF2α were injected IM. On day 12, the CIDR was removed and another dose of PGF2α was injected. Does were inseminated (200mms/mL) at a fixed time point (38 – 44 hours) after the second injection of PGF2α using a 5ml syringe attached to 9-inch AI sheath without the use of a speculum. To compare splashing to natural mating, another group of goats (Kiko n=47; Spanish n= 39) were bred by natural breeding to be used as a control. Pregnancy rate was determined using combined screening tests, where results from blood tests taken on day 35 were compared with ultrasound results taken at 60 days post AI. Data were analyzed using the MIXED procedure of SAS.

Results: Both screening tests showed similar results. Overall pregnancy rate for splashing was 22.50%, with breed pregnancy rate at 25% for Kiko and 20% for Spanish. The pregnancy rate for the Kiko and Spanish by natural mating 79 and 72 % respectively.

Impact: AI by splashing is a simple technique that can be used in small ruminant reproduction rather than the traditional method of vaginal insemination. Despite a low initial success rate, conducting further trials is recommended to refine and improve the technique, potentially leading to better outcomes and a higher rate of success.

Mississippi State University

Department of Animal and Dairy Sciences

Reproductive performance with two CIDRs permanency for estrus synchronization in Spanish goats

Caelin Hodges, Kelsey Mazeres, Ke'Daja Freelon[1], Larry Leon-Medina, Maxwell Mkunga, Dr. Rhonda Vann, Dr. Juan Romano[2], Dr. Leyla Rios de Alvarez

[1]Department of Wildlife, Fisheries, and Aquaculture; [2]3R Ranch Livestock Co., Somerville, TX.

Objectives: This preliminary study aimed to evaluate two different durations of CIDR® inserts (Eazi Breed™ for sheep, 0.3 g of progesterone – P4) in ten (n=10) cycling female Spanish goats (IACUC-24-257). Does were randomly allocated into two (02) groups, G1- 2 weeks with CIDR®, and G2-1 week with CIDR®. Each group had 2 young does, and 3 adult does.

Procedure: All does were confined in a collective pen with *ad libitum* hay (mixed Bahia and Bermuda), loose minerals, and water and received approx. 220 g/animal/day of commercial concentrate (13% CP). The protocol used for synchronization was: on day minus fourteen (-14, June 17th, 2024), CIDRs were inserted vaginally on G1, and immediately after, each doe received 1 ml of gonadorelin (synthetic GnRH: 50 µg/ml; Factrel®) by intramuscular (IM) route in the neck muscles. On day minus seven (-7, June 24th, 2024) G2 got the CIDR® + GnRH injection. On day zero (0, July 1st, 2024), all does had the CIDR® removed and received 1 ml of Dinoprost Tromethamine (natural PGF2α; 5 mg/ml; Lutalyse®), IM on the neck. Starting on the same day 0 a proven Spanish male (3 years old) was taken to the does twice a day (8:00 h and 17:00h) for 30 to 45 minutes until every doe was mated twice (12 h apart). The male bred all 10 does in 3 days, from day 2 to 4 post removal of CIDR®. All does were returned to normal grazing management after the 2 matings were completed. In both groups, weights (BW), number (NK), and sex of kids (SK) were compared using ANOVA (SAS 8.3), Chi-Square test was used to evaluate the distribution of the SK in the groups.

Results: No differences were found for BW of does or kids, NK and SK (P=0.40), BW of G1 does was 41.19 kg, with 10 kids, 7 females, and 3 males, and 2.69 kg and 2.96 kg of BW, respectively. G2 does had a BW of 38.96 kg, 13 kids, 3 females and 10 males, with 2.12 and 2.52 kg of BW, respectively. The Chi-Square test showed a significant difference in the distribution of SK in the groups (P=0.02). These preliminary results show that the duration of the CIDR® for the synchronization of Spanish does did not have any effect on the NK and BW of the kids.

Impact: This protocol can be successfully applied using one or two weeks of CIDR®, GnRH, and PGF2α, allowing a shorter kidding season and easier management of one group of growing. The study will be repeated with a larger number of does in 2025.

Tennessee State University

Disproportionate kidding times as an indicator of buck-induced estrus in cycling meat goat does.

Adamopoulos, T., Pearson, L., Hayes, E. G., Browning, R., Jr.

Objectives: Meat goat producers may benefit from shortening the breeding season and, in turn, shortening the kidding season to decrease the age disparity among kids at weaning. Using estrous synchronization protocols (i.e., progesterone therapy, prostaglandin treatment) is one approach. Buck exposure can induce ovarian cyclicity and estrous synchronization in does during seasonal anestrous. However, it is unclear if buck exposure modifies active ovarian cycles during the normal short-day caprine breeding season. Buck-induced estrus in cycling does could cause a disproportional proportion of does to kid early in the kidding season. Without a buck effect, 5% of does within a herd are expected to express estrus daily on average during a 21-d estrous cycle, theoretically leading to a relatively uniform number of does kidding daily in the first 3-4 weeks of the kidding season.

Procedure: This study looked at the relationship between expected and observed kidding dates. The start of each kidding season was estimated based on the date service sires were introduced to start each breeding season and a 150-day gestation. Kidding records that spanned 14 years were analyzed from Boer- and Savanna- (BV; n = 245), Kiko- (K; n = 547), Myotonic- (M; n = 238), and Spanish-sired does (S; n = 487). Each year, the herd was split so that does were bred in October or December for March or May kidding. Chi-square tests were performed within breed and month to compare the actual proportion of does that kidded within 7- or 10-days of the estimated start of the kidding season with the expected proportion of does kidding using a 5% daily kidding rate. Only does that kidded within 26 days of the expected start of the kidding season were used in this study. Across years and breeds, data used included 960 March kiddings and 557 May kiddings.

Results: Within each doe breed group, a higher proportion of does kidded within the first 7- and 10-d of the kidding season than expected. For BV does, the 7- and 10-d observed kiddings (59.6%; 76.7%) were higher ($p < 0.001$) than the expected kiddings (33.5%; 49.8%). For K does, 7- and 10-d observed kiddings (56.5%; 70.2%) were higher ($p < 0.001$) than the expected (32.9%; 49.9%). For M does, 7- and 10-d observed kiddings (53.4%; 68.9%) were higher ($p < 0.001$) than expected kiddings (32.8%; 50.0%). For S does, the 7- and 10-d observed kiddings (47.6%; 66.9%) were higher ($p < 0.001$) than expected (32.9%; 49.9%). A buck effect was indicated in the October and December breeding seasons across doe breeds. In the March kidding season, the 7- and 10-d observed kiddings (58.4%; 75.8%) were higher ($p < 0.001$) than what was expected (33.0%; 50.0%). During the May kidding season, 7- and 10-d observed kiddings (45.4%; 60.0%) were higher ($p < 0.001$) than expected kiddings (33.0%; 49.9%).

Impact: The data suggest that service sires induced estrus in cycling does. It is possible to shorten the breeding season in meat goat herds without compromising kid production. Recognizing a buck effect on cycling does during a normal short-day breeding season can be favorable for various aspects of herd management. Further research may be useful in assessing the physiological basis of how bucks might alter ovarian cycles in meat goat does.

Effect of yearling weight and internal parasite indicator traits on pregnancy rates in young meat goat replacement does

Anthony, N., Garnett, K. Hayes, E. G., Browning, R., Jr.

Objectives: Selection of superior replacement females is important to sustaining a productive meat goat herd. Selection criteria such as body weight and parasite burden in young stock may impact future reproductive efficiency. Most meat goat herds rely on phenotypic selection to assess herd replacements. If does are expected to kid for the first time as two-year-olds, yearling traits before the first breeding season may be useful in a selection plan.

Procedure: This study analyzed how body weight and parasite burden recorded at one year of age influenced fertility rates of two-year-old meat goat does. Body weight, fecal egg count (FEC), and packed cell volume (PCV) were recorded on yearlings does (n = 407) over eight years. Yearling weight ratios were calculated from the body weights and categorized as low (< 87), moderately low (87-99), moderately high (100-112), or high (> 112). Fecal egg counts were recorded using the Modified McMaster technique. Sire breed and dam age were also recorded for analysis of the replacement doeling population. Bucks were put out approximately 6 months after body weight, FEC, and PCV were recorded. Yearlings were grouped by PCV (low: < 24%; moderately low: 24-26.5%; moderately high: 27-28.5%; high: > 28.5%) and by FEC (high: 1000+ eggs/gram; low: < 1000 eggs/gram).

Results: Yearlings with low weight ratios had a pregnancy rate (37.5 ± 7.9%) that was lower ($p < 0.05$) compared to yearlings with moderately low, moderately high, and high ratios (60.8 ± 7.5%, 73.4 ± 6.3%, and 79.0 ± 5.8%, respectively). Pregnancy rate was also higher ($p < 0.05$) for high weight ratio yearlings than cohorts with moderately low ratios. Yearlings with low PCV had a reduced ($p < 0.05$) pregnancy rate as two-year-olds compared to does with high PCV (36.4 ± 10.5% vs. 71.6 ± 8.8%). Yearlings with moderately high and moderately low PCV had moderate pregnancy rates that did not differ from the two extreme groups. Yearling FEC did not affect ($p > 0.05$) pregnancy rates (high FEC: 57.2 ± 7.8% vs. low FEC: 58.9 ± 7.9%). Sire breed and dam age also affected ($p < 0.05$) replacement doe fertility rates. Boer- and Savanna-sired does as a combined group had a lower ($p < 0.05$) pregnancy rate (31.9 ± 6.6%) compared to Spanish-, Kiko-, and Myotonic-sired does (65.5 ± 7.4%, 68.9 ± 6.9%, and 83.0 ± 6.3%, respectively). Yearlings born to two-year-old dams had lower ($p < 0.05$) pregnancy rates than yearlings born to three-year-old dams (46.3 ± 9.4% vs. 79.3 ± 6.1%). Pregnancy rates did not differ ($p < 0.05$) among any other age groups that included 4, 5, and 6+ year old dam groups.

Impact: The results show that the relative body weight (weight ratio) of doelings at a year of age can influence their reproductive rate as two-year-olds. While PCV affected fertility rate in this study, FEC did not. Further analysis needs to be done on the relationship between yearling PCV and FEC in this population of doelings. This study suggests that producers can use yearling weight ratios and some aspect of internal parasite monitoring in replacement doeling selection and management to enhance first breeding outcomes.

University of Florida

Maternal Supplementation of Rumen-Protected Choline During the Peri-conceptional Period Skews the Sex Ratio of Lambs

Masroor Sagheer, Quinn A. Hoorn, Daniel Carballo[1], Mariangela BC Maldonado[2], Brittany N. Diehl, Peter J. Hansen
[1]EARTH University, Guácimo 442-1000, Costa Rica; [2]Morfeld Research & Conservation, LLC, Brenham, Texas, USA

Objectives: This study aimed to assess the effects of rumen-protected choline (RPC) on plasma choline and its metabolites and to test whether oral administration of RPC to ewes during the peri-conceptional period programs postnatal development of lambs.

Procedure: In the first experiment, a total of 5 adult ewes housed in a single pasture were individually administered a single oral bolus of 5g RPC (3g choline chloride). Blood samples (5 mL) were collected by jugular venipuncture before (0 h) and 2, 4, 6, 8, and 10 h after bolus administration into EDTA-containing tubes and immediately centrifuged at 3000 × g for 15 min to obtain the blood plasma fraction. Concentrations of choline, betaine, dimethylglycine, methionine, and TMAO in plasma were determined by liquid chromatography coupled with tandem mass spectrometry while plasma concentrations of phosphatidylcholine, sphingomyelin, and lysophosphatidylcholine were measured by liquid chromatography-mass spectrometry. In the second experiment, 183 ewes were treated with RPC or a control capsule from day -1 to day 7 after breeding and data on pregnancy outcomes and postnatal phenotype of the lambs were collected.

Results: In the first experiment, oral administration of RPC increased plasma concentrations of choline, TMAO, sphingomyelin, and lysophosphatidylcholine, and decreased plasma concentrations of methionine. In the second experiment, RPC did not affect pregnancy outcomes or lambing rate but skewed the sex ratio towards females (62% for RPC vs. 44% for control). RPC did not affect birth weight, weight through weaning, average daily gain, and testis weight. RPC increased the Longissimus thoracis muscle area (cm2) at an average age of 169 d.

Impact: Results from the present study showed that maternal supplementation of RPC during the periconceptional period can shift the sex ratio towards females and increase the the L. thoracis muscle area of the resultant lambs. These data provide evidence for the environmental modification of sex ratio in mammals. Producers can utilize RPC in their flocks to enhance the numbers of female lambs.

USDA, Agricultural Research Service, Booneville, AR

Identification of traits of longevity and robustness in sheep

J.M. Burke, T. Murphy, B. Freking, E. Wood, C. Lee (USDA, ARS)

Objective: One half of all cull ewes each year are culled prematurely, and udder health issues account for 13.8% of those. Udder morphometric traits were examined to determine their variability and correlation with other traits measured in the Booneville ARS flock.
Procedure: Katahdin ewes (n = 413) lambed in October (F; ≥2 yr of age; 2021 – 2024; n = 309) and January (W; ≥1 yr of age; 2022 – 2024; n = 104). Ewes that lambed in W were rebred for F lambing and typically after that lamb once per year. Ewes lambed on grass pastures assisted only as needed and lambs were weighed and ear tagged within 12 h post-birth. Udder health and morphology traits were measured ~5 d (early PP) and 30.9 ± 0.9 d later (late PP). Data were analyzed using Proc GLM (SAS) and included yr, lambing mo and ewe age (1, 2, 3, 4, ≥5 yr) in the model. Proc Corr was used to examine simple relationships between traits.
Results: There were more live lambs born and weaned in W than F (2.1 ± 0.09 vs 1.6 ± 0.04, $P < 0.001$; 1.9 ± 0.09 vs 1.5 ± 0.04, $P < 0.001$, respectively) and in ewes > 2 yr of age than yearlings ($P < 0.001$). Similarly, litter birth weight was greater in W than F ($P < 0.001$) and in ewes > 2yr than yearlings ($P < 0.001$). Udder depth (1 = deep; 9 = shallow) was more shallow in F than W in early PP (7.8 ± 0.07 vs 7.4 ± 0.17 units, $P = 0.05$) and late PP (8.1 ± 0.07 vs 7.2 ± 0.16 units, $P < 0.001$) and became deeper with age ($P < 0.001$). Teat length was longer in W than F in early PP ($P = 0.02$) but similar in late PP and increased with age in early PP ($P = 0.006$). Degree of separation between udder halves was similar early PP, but lower in yearling than older ewes in late PP ($P = 0.004$). Degree of separation in early PP but not late PP was positively correlated with ewe BW and BCS determined between breeding and late PP ($P < 0.004$). Traits that were highly correlated ($P < 0.001$) between early and late PP were teat placement, udder depth, degree of separation, udder symmetry, teat length, udder hardness, and teat damage (right and left).
Impact: Next steps are to combine data with other ARS and industry flocks to examine genetic and phenotypic parameters for traits associated with ewe productivity, health, and longevity. Identifying genetic components for udder traits will lead to development of selection tools for improved udder health.

Objective 4: Disseminate research results and information to stakeholders

Fort Valley State University

Educational videos posted online. N.C. Whitley, R. Edwards (FoxPipe Farm), T. Terrill, D. J. Obrien (Virginia State University)

Objective: The objective was to provide educational materials to producers and other ag professionals.

Procedure: Pre-recorded video views from the last year at the following website: https://www.youtube.com/@nikiwhitley981/videos were scanned for this report.

Results: Views for the last year (3/1/24-3/16/25):

- Sericea lespedeza growing/harvesting hay/weed control (three videos developed by FVSU over the past few years as part of a SSARE project): **908 total views in the last year**.
- Grazing away parasites – 29 views
- When Deworming is not Enough – 22 views
- Selecting Parasite Resistant Animals (D.J. O'Brien, VSU) – 24 views
- **Spanish translated:**
    - **Copper oxide wire particles-12 views**
    - **Using dewormers – 72 views**

Impact: With these videos, producers and other ag professionals can increase their knowledge of these topics to improve small ruminant farms/parasite control.

Online and In-person Livestock Integrated Parasite Management/FAMACHA© Training
N. C. Whitley, D.J. O'Brien (Virginia State University); Georgia Extension Agents

Objective: The objective was to train producers and other ag professionals in integrated gastrointestinal parasite control.

Procedure: Online training was offered via pre-recorded videos and links provided at www.wormx.info. In-person training was conducted at two locations. Resources related to parasite control were provided to UGA Extension agents, including links to wormx.info and sheepandgoat.com.

Results: The online Video has received at least 348 views in the last year (3/1/24 – 3/16/25). See Virginia State University report for more information. In-person training resulted in at least 28 certifications. Additional parasite-related training was offered to at least 24 people.

Impact: With this training, field staff and farmers are better able to understand how to manage GIN parasites in small ruminants.

Langston University

Langston University Conference on Sustainable Agriculture including Goats and Hair Sheep

Author (s): Roger Merkel

Objective: The Langston University Sustainable Agriculture Conference combines the traditional Goat and Hair Sheep Field Day held annually since 1986 with the Small Farmers Conference that had been a separate event. Combining both events allows the university to reach a wider audience as it strives to disseminate research and extension information. The event's objective is to educate producers by equipping them with the essential skills, knowledge, and abilities to profitably sustain their small ruminant operations. Feedback from participants is always solicited and the themes of future Goat and Hair Sheep Field Days change to reflect that input.

Procedure: The conference was held on April 26 and 27, 2024 with the theme of "Bringing Together Families, Communities, Food & Agricultural Systems." The conference had four tracks of information from which producers could attend. The sheep and goat track was entitled "Small Ruminants Production, Management, and Value-Added Products: Goats and Sheep." In response to feedback from 2023 when small ruminant presentations were given on the second day only, in 2024 small ruminant presentations were given on both days of the event. These presentations included hands-on and classroom sessions, and two producer participating workshops.

Results: A wide variety of presentations on small ruminants were given including:

- Goat Nutrition using the Langston Interactive Nutrient Calculator (LINC) by Dr. Amlan Patra
- Procedures of the Dairy Herd Improvement Lab by Dr. Hirut Tejeji
- Goat Milk Health Claims by Dr. Carlos Alvarado
- Basic Herd Health and Management, Goat Husbandry by Drs. Roger Merkel and Lionel Dawson.
- Is Your Sheep or Goat Sick? by Dr. Lionel Dawson
- Goat Reproductive Techniques by Drs. Adel Ghnenis and Jerono Kiptanui

Hands-on workshops included:

- Showing and Fitting Goats for Youth and Adults by Kelsey Pfeiffer, Pfeiffer Farms, Mulhall, OK
- Cheesemaking: Crafting Soft Lactic & Semi Hard Goat Cheese by Dr. Carlos Alvarado
- Goat Milk Soap Making by Natalie Paige, The Bearded Doe and Company, Coyle, OK

Impact: Approximately 200 people attended the conference. The small ruminant workshops were well attended and well liked. Many favorable comments were received about the conference. Feedback also revealed that attendees want more hands-on sessions with sheep and goats to learn and practice management techniques. This will be taken into consideration for future conferences.

Mississippi State University
Analysis of Seasonal, Sex, and Age Group Effects on Weight and Parasitic Load in a Spanish goat herd in Mississippi

Larry Leon, Kelsey Mazeres, Caelin Hodges, Ke'Daja Freelon[1], Maxwell Mkunga, Nicolas Marchant[2], Kipp Brown[3], Leyla Rios

[1]Department of Wildlife, Fisheries, and Aquaculture; [2]College of Veterinary Medicine; [3]Retired Livestock Coordinator, Mississippi State University, Mississippi State, MS, 39762.
Objectives: The objective of the study is to evaluate the impact of the season (S) [Autumn-Au, Winter-Wi, Spring-Sp, Summer-Su], sex (Ss) [males-M and females-F] and age group (Ag) [adults-Ad, animals born before 2023; and Young-Yg, animals born in 2023 and 2024], on the body weight (BW), body condition score (BCS), FAMACHA©, fecal egg count of nematodes (FEC expressed in eggs per gram of feces-EPG), and coccidias (OPG, oocysts per gram of feces). A herd of 24 registered Spanish goats grazing in a rotational system supplemented with commercial concentrate (13% CP) was evaluated for a year (October 2023 to October 2024).

Procedure: The data were analyzed using SAS 9.4. PROC MEANS was used to calculate descriptive statistics. PROC MIXED analysis included S, Ss, and Ag as fixed effects, with animal as a random effect. LSMEANS was then used to generate a table for comparison (Table 1). Chi-square tests were conducted to examine the association between the categorical variables BCS and FAMACHA© and the fixed effects of S, Ss, and Ag. BW showed significant effects for S and Ag ($P< 0.00$).

Results: Animals in Wi and Sp weighed less than in Au, with decreases of -9.7 kg ($P< 0.00$) and -3.5 kg ($P=0.00$), respectively; while BW in Su was higher by +6.06 kg ($P< 0.00$), probably due to the increase of the biomass and quality of the grass, and the pregnancy of most of the Ad F. Ad weighed significantly more than Yg, with a difference of +24.18 kg ($P< 0.00$). Ss did not significantly affect BW ($P=0.61$). For EPG significant effects of Ss were found ($P=0.01$), with F showing lower EPG compared to M (Estimate=-0.27). No significant effect of S or Ag was detected on EPG. OPG was significantly affected by both S and Ag ($P< 0.00$ and $P=0.02$, respectively). Sp had the highest OPG (Estimate=0.44, $P< 0.00$) due to the weaning of the kids happening in this season; while Ad had a lower OPG compared to Yg (Estimate = -0.36, $P=0.02$), which is normal in growing animals developing their immunity. For FAMACHA©, S, Ss, and Ag we found a significant association between variables (χ^2=570.68, 52.09, and 12.41, respectively; all $P< 0.00$). Similarly, BCS S (χ^2=671.18, $P< 0.00$), Ss (χ^2=52.09, $P< 0.00$), and Ag (χ^2=12.41, $P< 0.00$) most animals presenting values of 2 and 3 respectively.

Table 1. Effect of Season, Age Group, and Sex on Body Weight and Parasitic Load of a Spanish goat herd in Mississippi.

Variable	Ag	Ss	Autumn	Winter	Spring	Summer
BW, kg	Ad	F	53.6±8.3^{a}	40.1±4.7^{baa}	40.4±4.2^{baa}	47.2±7.8^{caa}
		M	78.2±3.4^{a}	73.3±1.4^{baa}	78.1±4.2^{baa}	83.3± 6.0^{caa}
	Yg	F	29.7±14.6^{aba}	16.7±6.4^{bba}	23.6±5.7^{bba}	31.1±6.4^{cba}
		M	18.2±14.4^{aba}	18.9±10.2^{bba}	29.4±11.0^{bba}	38.6± 9.5^{cba}
FEC, EPG	Ad	F	834.6±736.4^{a}	927.1±1473.1^{aab}	649.4±878.1^{aac}	616.6±470.8^{aad}
		M	755.5±689.8^{a}	100.0±173.2^{aab}	225.0±239.7^{aac}	625.0±35.3^{aad}
	Yg	F	362.2±368.3^{a}	2500.3±5961.4^{aab}	743.3±539.4^{aac}	644.7±807.4^{aad}
		M	844.1±755.1^{a}	3808.3±7143^{aab}	1751.7±1359.0^{aac}	1713.1±1640.9^{aad}
Coccidia, OPG	Ad	F	257.1±344.4^{a}	685.8±705.0^{bba}	280.9±261.4^{cca}	100.0±83.6^{dda}
		M	2116.6±2650.9^{a}	1816.6±2065^{bba}	3000±4538.9^{cca}	5600.0±4313.5^{dda}
	Yg	F	362.2±368.3^{a}	2990.0±6095.1^{bba}	9105.0±18181.6^{cca}	642.1±590.2^{dda}
		M	610.5±902.4^{a}	4245.6±12469.2^{bba}	13301.7±25952.2^{cca}	755.2±785.4^{dda}

BW: Body Weight; FEC: Fecal Egg Count expressed in Eggs per gram of feces (EPG); Coccidia expressed in Oocyst per gram of feces (OPG).
[1]S, Season (Autumn, Winter, Spring, Summer)
[2]Ag, Age Group (Ad, Adult; Yg, Young)
[3]Ss, Sex (F, Female; M, Male)
Different superscripts in the same row indicate significant differences (P< 0.05)

Impact: The study highlights the significant influence of seasonal changes, sex, and age group on the weight and parasitic load in goats. These findings can inform management practices to optimize animal health and productivity.

Workshops and demonstrations for farmers, students, and 4H families

Kelsey Mazeres, Caelin Hodges, Ke'Daja Freelon[1], Larry Leon, Maxwell Mkunga, Asia Irons, Leyla Rios

[1]Department of Wildlife, Fisheries, and Aquaculture, Mississippi State, MS, 39762. [2]Pearl River Extension Office; [3]White Sand Research Center, Poplarville, Mississippi State University, 39470, MS.

Objectives: Train farmers, students and 4H families on important skills for the management of small ruminant herds

Procedure: **1) ORGANIZER & TRAIN THE TRAINER: P**arasite Identification for Extension Agent** (December 16, 2024). Train the Trainer for Parasite Identification was funded through SARE. They sponsor the kits given to the Extension Agents and since Ms. Lacy is the new extension agent for Union Count, after being trained for FAMACHA© had this session of parasite identification at ADS to help sheep and goat farmers from her County. **2) TALK AND HANDS**

ON DEMONSTRATION: Brook's Family Farm Field Day by undergrad and graduate students (November 9, 2024). **3) TALK AND HANDS ON DEMONSTRATION Field Day at Mr. JB' s Farm:** Welcome to Goat Management / a 4H introduction to small ruminants (October 15, 2024). **4) ORGANIZER / SUPERVISOR EXTENSION BUCK TEST: for Kiko Goat Farmers** from the Southeast (June to August 2024). **5) TALK AND HANDS ON DEMONSTRATION: NRCS Visiting a Commercial Dairy Goat Farm** (August 28, 2024). **6) TRAIN THE TRAINER: FAMACHA CERTIFICATION for MSSTATE Extension agents** (August 7, 2024). **7) ORGANIZER & TRAIN THE TRAINER: FAMACHA CERTIFICATION for ADS Students and International Fellows** (June 18, 2024). **8) TALK AND HANDS ON DEMONSTRATION: UCAC Outreach Meeting for Farmers/Ranchers/Landowners** (June 8, 2024). **9) TRAINING FOR FARMERS: FAMACHA training for sheep and goat farmers organized by Two Brothers** (May 11, 2025). **10) TALK AND HANDS ON DEMONSTRATION: Outreach Meeting for Farmers/Ranchers/Landowners/Organized by UCAC & Brook's Family Farm** (April 103, 2024)

Results: **1) Train the Trainer:** Ms. Lacy is the new extension agent for Union County, after being trained for FAMACHA©, was trained for parasite identification at ADS to help sheep and goat farmers from Union County. (1 participant). **2) Field Day at Ms. Elmarie's Farm** with the support of UCAC and demonstrations for minority farmers by undergraduate students Kelsey Mazeres, Ke'Daja Freelon on health care and Caelin Hodges and by graduate students Maxwell Mkunga and Larry Leon related to fecal analysis for parasite control. Post in social media: https://www.facebook.com/share/r/1B4qKVfWfo/ (25 participants). **3) Field Day at Mr. JB's Farm**, with the support of undergraduate and graduate students, McMaster, body condition score, hoof trimming and FAMACHA© demonstrations to farmers and 4H. Hands-on demonstrations Kelsey Mazeres, Larry Leon, Maxwell Mkunga, Caelin Hodges, & Asia Irons. https://www.instagram.com/p/DBM6-dBv0N1/?utm_source=ig_web_copy_link&igsh=MzRlODBiNWFlZA== (20 Participants). **4) This second Southeastern Buck Performance Test** aims to improve the profitability of the meat goat industry in the region by improving meat goat genetics. The test was developed at the CREC White Sand farm and coordinated by Dr. Leyla Rios, Extension small ruminant specialist, Dr. Barbara Roqueto dos Reis (CREC White Sand), and Mr. Alex Shook (Extension Agent Pearl River County) with the support and contribution from Dr. Rhonda Vann (ultrasounds), Dr. Rocky Lemus (Forage samples) & Dr. Trent Smith (Data analysis). The objective is to improve current and prospective Mississippi producers' herds and, as a result, create a strong market for their products. This test will also help other producers in the Southeast region. Goat farmers from 13 states and all goat farmers interested in meat production (50 participants). Field day: https://www.instagram.com/reel/C_b7NeAIjHz/?utm_source=ig_web_copy_link (15 participants). **5) Field day at Cole's Ridge Farm to train new NRCS Agents** about small ruminants, specifically Dairy Goats, Talk on parasite control, Leyla Rios, McMaster Demonstration, Larry Leon https://www.facebook.com/share/p/1BZcM3hwSS/ (20 participants). **6) Train the Trainer: FAMACHA© Certification for MSSTATE Extension agents:** The new version of the FAMACHA© / Train the Trainer was organized using SARE Funds. They sponsor the kits given to the participants, making the training free for all participants. This training includes a new version of the FAMACHA presentation developed by the American Consortium for Small Ruminant Parasite Control (ACSRPC). Link to social media https://www.facebook.com/share/r/1MLJg5mHvq/ (10 participants). **7) Train the Trainer: FAMACHA© Certification for ADS Students and International Fellows.** The new version of the FAMACHA© / Train the Trainer was organized

using SARE Funds. They sponsor the kits given to the participants, making the training free for all participants. This training includes a new version of the FAMACHA© presentation developed by the American Consortium for Small Ruminant Parasite Control (ACSRPC). The group of participants included 2 fellows from Africa who work in Extension and will use the skills back in their country, link to social media https://www.facebook.com/share/p/19r6TxopoY/ (7 participants). **8) Talk and Hands-on Demonstrations: UCAC Outreach Meeting for Farmers/Ranchers/Landowners**. Field Day at Elmarie Brooks Farm, with the support of Unlimited Community Agricultural Cooperative. Hands-on demonstrations, Kelsey Mazeres & Ke'Daja Freelon. https://www.instagram.com/p/C7-Mqa6vfVf/?utm_source=ig_web_copy_link&igsh=MzRlODBiNWFlZA== (20 Participants). **9) Training for Farmers: FAMACHA© training for sheep and goat farmers organized by Two Brothers**. The new version of the FAMACHA© / Train the Trainer was organized using SARE Funds, which sponsor the kits given to the participants, making the training free for all participants. This training includes a new version of the FAMACHA© presentation developed by the American Consortium for Small Ruminant Parasite Control (ACSRPC). The group of participants, farmers, mostly women, was organized by Two Brothers (NGO) https://www.instagram.com/p/C64Np2euYlr/?utm_source=ig_web_copy_link&igsh=MzRlODBiNWFlZA== (6 participants). **10) Talk and Hands-on Demonstrations: Outreach Meeting for Farmers/Ranchers/Landowners/Organized by UCAC & Brook's Family Farm.** (19 participants). **Total Number of Participants during 2024: 178**

Impact: These training, field days and workshops have been great opportunities for contacting farmers, students and 4H families needing information on how to raise efficiently sheep and goats, with a focus on health (parasite control, hoof health, etc.). Also, a great opportunity to get undergraduate and graduate students exposed to Extension activities for sheep and goat farmers.

University of Florida

a. Small Ruminant Short Course (September 20-21, 2024)

Objective: The objective of the 3rd Annual UF Small Ruminant Short Course was to bring together researchers, extension agents, industry professionals, and small ruminant producers to share information, resources, and best practices. The aim was to improve the management, productivity, and sustainability of small ruminant operations by fostering collaboration and providing science-based, practical education.

Results: The 3rd Annual UF Small Ruminant Short Course, held from September 19–21, 2024, delivered a well-rounded program that engaged participants through a variety of educational activities. The event began with three pre-conference seminars designed for immersive, hands-on learning. These sessions provided valuable training in small ruminant carcass evaluation and processing, pasture management and rotational grazing techniques, and essential veterinary skills such as venipuncture, FAMACHA scoring, and hoof trimming. These workshops allowed participants to directly apply technical skills under expert guidance in small group settings, maximizing interaction and individualized instruction.

On September 20, the full-day conference featured a diverse lineup of expert presentations on key topics affecting small ruminant production. Presenters addressed enterprise development, sustainable forage systems, the role of choline supplementation during breeding, the interplay of host genetics and microbiota, and advanced parasite management strategies. Additional talks focused on small ruminant meat grading and marketing, common health challenges, and specific nutrient requirements like vitamins and minerals. This day emphasized the integration of research-based knowledge into practical farm management, supported by UF and USDA scientists and veterinarians.

The evening program on September 20 transitioned to a cocktail hour and trade show at the UF/IFAS Horse Teaching Unit, where participants viewed UF Ram Test animals and interacted with industry representatives. This created an opportunity for informal networking, producer engagement, and exposure to new tools and technologies.

On September 21, the program continued with interactive breakout sessions and rotating demonstrations at the Horse Teaching Unit. Topics included pasture weed control, fecal egg counts, business planning for small ruminant operations, toxic plant identification, nutrition, and lamb cooking demonstrations. These sessions allowed participants to explore multiple practical areas in short, focused rotations. The event concluded with an advanced FAMACHA training session at the UF Sheep Unit, which required pre-registration and offered targeted instruction in parasite management through visual anemia scoring—a critical tool for sustainable deworming strategies.

Overall, the course provided a comprehensive mix of formal presentations, hands-on workshops, practical demonstrations, and networking opportunities. Participation from researchers, extension agents, veterinarians, and producers created a dynamic learning environment that addressed both current challenges and innovations in small ruminant production..

Impact: The course successfully enhanced the knowledge and practical skills of small ruminant producers, particularly in areas of animal health, nutrition, grazing, and business planning. By

combining research updates with field demonstrations, the event fostered deeper understanding and adoption of best practices. The engagement of producers and positive feedback highlight the course's value in building capacity and strengthening the small ruminant industry in Florida and the southeastern United States.

b. Ram test (June-September 2024)

Objective: Our 4th annual UF Ram Test was designed to quantify the desirable qualities of the consigned rams within a standardized environment. The primary qualities identified to quantify through this test include growth performance and parasite resistance. This program provides an opportunity for unbiased data to be collected for comparison as well as educational and networking opportunities for both producers and university personnel (faculty, staff, extension agents). We had participation from producers in FL and GA with 41 rams being consigned, initially. At the conclusion of the test, the data parameters are quantified into ratio indices to compare each ram. The top performing 17 rams were eligible for auction.
Results: 44 rams enrolled and 34 completed the test for 2024 – 18 rams were sale eligible. Rams were sold online (Willoughby Sales online auction) for an average of $922/ram and the highest selling ram sold for $5,350. NSIP enrolled rams, average sale price was $3,575/ram.
Impact: This program just completed its 3rd year and has grown in popularity amongst sheep producers. In response to the small ruminant industry's desire for expansion of these programs, we will be launching our inaugural UF Buck Test & Sale in 2024. This Buck Test will run parallel but separately from our UF Ram Test. The online sale of the top performing rams and bucks will take place at the 2024 UF/IFAS Small Ruminant Short Course.

c. Buck test (June – September 2024)

Objective: The objective of the UF Buck Test was to evaluate the performance, adaptability, and survivability of consigned bucks under the challenging environmental conditions of Florida. The test aimed to identify genetics capable of thriving in hot, humid climates, providing producers with data to guide breeding and selection decisions.
Results: In its inaugural year, the buck test drew participation from producers in 13 states, with 42 bucks enrolled and 39 completing the program. Due to the harsh Florida environment, only five bucks met the performance criteria for sale eligibility. However, the producers of these top-performing bucks chose to retain their animals for future breeding, resulting in no public sale for 2024. Despite this, the test received strong positive feedback for its rigorous evaluation process.
Impact: The UF Buck Test successfully established itself as a meaningful and rigorous program for identifying resilient genetics suited to extreme climates. It attracted national interest, highlighted the performance gap among bucks under environmental stress, and encouraged data-driven genetic selection. The positive reception by producers underscores the value of such a test in helping the industry advance toward hardier and more productive herds.

Test Participation

	2021 Ram Test	2022 Ram Test	2023 Ram Test	2024 Ram Test	2024 Buck Test
No. enrolled	41	37	45	44	42
No. completed test	34	33	41	34	39
Breeds	5	5	6	6	1
States represented	FL, GA (2)	FL, GA (2)	FL, GA (2)	FL, GA (2)	FL, GA, AR, AL, IN, MS, KY, OK, KS, SC (10)
No. sale eligible	16	17	21	18	5
Sale price average	$420	$706	$922	$890	---
Sale price range	---	$300-$2,000	$300-$5,350	$0-$2,350	---

Virginia State University

Pasture Lambing Workshops Introduce Farmers to Techniques that Increase Dam and Lamb Survival

Dahlia O'Brien, Stephan Wildeus and Mackenzie Spencer

Objectives: According to the National Agricultural Statistics Service, Virginia sheep numbers in 2024 increased by 8% from 2023. Hair sheep are the fastest growing segment of the US sheep industry. This is because they are well suited for sustainable, pasture-based production and are a good fit for novice producers. When starting out, one of the most stressful times for a shepherd is lambing. Many producers do not realize that pasture lambing is an option, especially if you wish to promote mothering up, reduce lamb losses and cut down on labor and feed demands associated with in-door lambing systems. However, lambing on pasture requires specific skills that are crucial for the success of sheep farming operations. Effective management during lambing season involves strict observation, problem recognition, and quick intervention to ensure the health and survival of both ewes (female sheep) and lambs. Essential skills include developing a newborn lamb protocol, recognizing and treating health issues such as, pregnancy toxemia, and performing tasks such as ear tagging and tubing if necessary. Practical skills like using lambing ropes and snares are also important for assisting in difficult births. Since 2019, four hands-on workshops were developed and implemented to introduce pasture lambing as an option for VA's hair sheep producers and increase their knowledge and skills to help in reducing ewe and lamb loss during this critical time

Procedure: Each workshop was limited to 16 participants to facilitate hands on learning and more one-on-one interactions. At these workshops, participants learned about the biology of pregnancy and lambing, preparation for lambing, supplies needed, and dealing with complications and the unexpected during the morning session. In the afternoon, participants learned how to deal with difficult births aided by a lambing simulator developed at VSU. Multiple lambs were arranged in various breeched positions and participants had to successfully re-position and pull all to potentially save the lives of both lambs and mother.

Results: To evaluate the impact of this program since its inception in 2019, a follow-up survey was emailed to all 64 participants in the fall of 2024 to determine participant satisfaction, skills developed, and economic benefits realized from their participation in the workshop. There was a response rate of 24% (15/64).

Impact: Generated impacts include: **Participant satisfaction:** 100% of respondents rated the program good to excellent 94% of participants would recommend the program to other producers/stakeholders 100% of participants indicated that they are currently implementing skills learned during lambing and kidding 93% indicated that they gained helpful resources, hands-on sills, a wider network of producers and answers to their questions by participating in this program. **Producer livelihoods improved:** 80% of respondents indicated that they have seen an economic benefit from what they learned by participating in this program (20% saved $1 - $99; 20% saved $200 - $300; and 40% saved >$300).

Farm to Fork Hair Sheep Field Day educates and demonstrates best practices for raising hair sheep in Virginia

Dahlia O'Brien, Stephan Wildeus, Davida Rimm-Kaufman, Mackenzie Spencer, Susan Schoenian (University of Maryland), Kwame Matthews (Delaware State University)

Objectives: Hair sheep are an excellent choice for small and sustainable farms, especially in the mid-Atlantic US. These hardy animals thrive in pasture-based systems, resist parasites and heat stress, are exceptional mothers, and can be bred year-round. One of the biggest advantages? Hair sheep don't require shearing, making them increasingly popular among farmers who want to raise them for meat only. To demonstrate a sustainable and profitable hair sheep system, Virginia State University (VSU) has developed a semi-continuous lamb production system for year-round production of market lambs on pasture and forage. This year-round approach uses Barbados Blackbelly and St. Croix hair sheep breeds. It greatly enhances the marketing options and opportunities for producers and maximize the utilization of pastures and facilities, while limiting management and labor requirements. Additionally, this approach creates lambs that could be marketed under local value-added labels such as 'grass-fed' and 'organically raised'. The objective of this Field Day was to introduce producers to VSU's production system by providing an animal and facilities tour, opportunities for hands-on experience and update on ongoing research projects.

Procedure: In 2024, VSU planned and executed a Farm to Fork Hair Sheep with the goal of educating small ruminant producers about the Hair Sheep Program. Additionally, the Field Day provided hands on experiences in the following: 1) market readiness and carcass quality; 2) how to give intramuscular and subcutaneous injections; 3) the incidence of antibiotic resistance on farms; 4) identifying animals infected with internal parasites using the Five Point Check©; 5) correct drenching technique; 6) hoof trimming; and 7) correct technique for body condition scoring of small ruminants.

Results: The Field Day was limited to 60 participants to facilitate hands on learning opportunities. To evaluate the impact of the Field Day, an evaluation was given to each participant to complete at the end of the program.

Impact: **Participant satisfaction:** 70% had no previous knowledge about the content covered at the Field Day; 96% of respondents rated the Field Day good to excellent; 93% of participants agreed that they learned new information at the Field Day; 77% gained answers to questions they had; 93% gained new resources; 87% gained new hands-on skills in sheep management; and 47% increased their network contacts.

Virginia State University's Sheep Unit Introduces Technical Center High School Veterinary Science Students to Careers in Animal Science

Dahlia O'Brien, Stephan Wildeus, Mackenzie Spencer and Davida Rimm-Kaufman

Objectives: High school student participation in hands-on animal experiences can increase interest in agricultural studies at the college level. These programs provide practical skills in animal care

and management, fostering a deeper understanding of agriculture. These hands-on experiential learning opportunities help youth connect with agriculture on a practical level, making it a more appealing field of study. By engaging in real-world agricultural activities, students develop essential skills like problem-solving, teamwork, and leadership. Additionally, these experiences introduce students to various careers in agriculture, encouraging them to consider these fields for their future. For several years, Virginia State University has collaborated with the Chesterfield Career and Technical Center High School Veterinary Science Program to expose students to sheep management practices and techniques. This program introduces students to career pathways in Animal Science as well as provides hands on experiences to excite students about undergraduate programs at Virginia State University and other Land Grant Institutions. More recently, the program was expanded to include 2 additional counties.

Procedure: In 5 half-day programs in 2024, Virginia State University's Sheep Unit collaborated with 3 county Career and Technical Center Veterinary Science programs to expose high school students to sheep management and careers in animal science. The 3 counties included Chesterfield, Richmond and Henrico County. The program agenda consisted of 4 concurrent activities repeated such that each student participated in each. The activities included: 1) a tour of the facilities and description of hair sheep program; 2) ram semen collection and analysis/ultrasound diagnosis of pregnancy; 3) lambing simulator to assist with difficult birthing; and 4) internal parasite infection and diagnostic procedures. During lunch/breaks, the Sheep Unit team, including undergraduate student workers, described their educational background and what they enjoyed most about working with animals. High school students also have the opportunity to ask questions of faculty, technical staff and students.

Results: In 2024, this experiential educational program hosted 71 high school students from the Career and Technical Center Veterinary Science Programs in 3 counties. Hands-on activities increased student knowledge and skills in sheep handling and in sheep reproduction and health management techniques. Discussions centered on VSU's Sheep Program, career pathways of the Sheep Unit team and types of jobs in animal science led to an increase in student knowledge.

Impact: Programs such as this can positively impact the attitudes of high school students towards animal science/agriculture careers, increase their desire to study animal science in college, and creates a pathway for student recruitment.

Beyond the Farm: How Virginia State University's Mobile Processing Unit and Hair Sheep Programs are Impacting Food Security in the Petersburg Community

Davida Rimm-Kaufman, Stephan Wildeus and Dahlia O'Brien

Objectives: Food insecurity in Petersburg, Virginia is a pressing issue, characterized by limited access to sufficient, safe and nutritious food among residents. Despite the city's rich history, economic challenges and systemic disparities contribute to a high level of poverty. Petersburg's median household income in 2022 was $46,930, which is significantly lower than the national median in the same year, $74,580. Over 22% of Petersburg residents live under the poverty line, nearly twice as high as the average in Virginia. The impacts of food insecurity are widespread, impacting many aspects of life, from a child's ability to succeed in school to an adult's mental health. Nationwide, it is estimated that 30-40% of the food supply is wasted. The harm is multi-faceted, as wasted food could have fed families in need, and wastes resources used to produce the

food and energy needed for disposal. Virginia State University, situated in downtown Petersburg, has an obligation to support its community by extending University resources into areas most in need. Additionally, a fundamental goal of Virginia Cooperative Extension is "[to] improve economic, environmental and social well-being."

Procedure: Through a collaboration between Cooperative Extension and the Agricultural Research Station at VSU, lamb produced from research studies were donated to a Petersburg Food pantry. The research contributed to the forage-based accelerated lamb production model, demonstrated at VSU. All animals were raised at the VSU Sheep Unit and harvested under USDA inspection on the Mobile Processing Unit (MPU). After carcass data was collected, the lamb was cut into retail cuts and delivered to Hope Center Food Pantry in downtown Petersburg.

Results: Most meats donated to the food pantry are processed chicken or pork products. Farm fresh lamb was a welcome change. On one drop off, a client saw the meat and said "Yes! We'll have ribs for the fourth [of July]." Even clients without the resources to prepare raw meat still enjoyed our meat. In the month of August, the Hope Center kitchen served over 200 meals, with many featuring VSU lamb. From January through October of 2024, VSU donated meat from 19 animals, totaling well over 600 pounds.

Impact: Through continuous meat donations to the DCU Hope Center, VSU's Small Ruminant MPU Program has helped combat food insecurity, reduce food waste, and provide nutritious and unprocessed protein to individuals who otherwise wouldn't have access**.** VSU Lamb donations to the DCU Hope Center, as of October 2024, averaged $6500 in value (assuming the average lamb price for all cuts is $10.00/lb., an estimate based on price averages from local supermarkets). While hunger and poverty will continue to persist in Petersburg, VSU lamb donations have made a noticeable difference in the lives of many. Community partnerships as demonstrated here embody the essence of Virginia Cooperative Extension and the VSU College of Agriculture.

Supporting Producers through Meat Processing Services, Education, and Expertise
Davida Rimm-Kaufman, Dahlia O'Brien and Stephan Wildeus

Objectives: There is a well-documented shortage of USDA inspected meat processors in the state of Virginia, leading to a bottleneck in direct marketing for sheep and goat producers. This problem is exacerbated by plants giving preference to other species, due to lack of relative profitability of small ruminants. One major contributing factor to this bottleneck is a lack of skilled workers. Meat processing is a learned trade that can take years to master fully. Additionally, workers in small meat plants must fulfill a wide range of roles and responsibilities, from meat cutting to navigating food safety regulations, making the job difficult. There is little support and guidance for these processors that simply struggle to keep up. On the other side, small ruminant producers struggle to find a processor that will accept a low volume of animals on a sporadic basis. They may also have issues understanding cut sheets, pricing strategies, and marketing techniques. These are entirely separate skills that go beyond typical farming duties. With all of these factors considered, it is clear there is a large need for both small ruminant producer and processor support. The objective of this program is to be a processing resource for small producers and to conduct research-based educational programs on humane ruminant harvest and fabrication.

Procedure: Many efforts have been made by VSU to reduce the processing bottleneck for sheep and

goat producers. Previously, a preliminary feasibility study was executed. This established a certification program for producers to lease the MPU themselves to process animals under inspection on their farms. While this was positively received by producers, it was deemed logistically impractical due to mechanical, staffing, level of skill and compliance issues. In 2024, the MPU program offered inspected processing and workshops/trainings for our clientele.

Results: The MPU has offered 3 inspected processing dates for small ruminant producers in 2024, processing 24 sheep and goats for 4 producers. The MPU also hosted 4 demonstrations to support limited resource producers in direct marketing their meats, covering topics such as carcass evaluation, humane harvest of small ruminants, and more. In addition to live demonstrations and workshops, a set of seven Lamb and Goat Meat fact sheets were developed. Finally, the MPU team offered technical support to individuals working to build MPU's of their own.

Impact: In 2024, the MPU processed 24 head of sheep and goats, under inspection, for four producers. Educational workshops and demonstrations reached over 190 sheep and goat producers and increased the knowledge and skills in lamb harvest, and carcass fabrication, knife maintenance and food safety. 20 individuals received one-on-one technical advice, supporting their business. In an era in which meat facilities are generally shut off to the public, opportunities like these are unique in that they increase accessibility of meat processing to a broad audience.

University of Arkansas

The Arkansas Extension Small Ruminant Program aims to increase producer knowledge and understanding of small ruminant husbandry/health, production, and marketing. It is a collaborative, multi-agency, transdisciplinary program that includes all small ruminant value chain segments. We organized events, spoke in meetings, visited farmers, and used diverse media channels to disseminate research-based information to stakeholders.

Public, non-cost events organized

Small ruminant workshop – Lambing/Kidding School. Black Rock, AR, January 23, 2024. This program was organized to educate producers about the management practices of pregnant ewes and newborn lambs to reduce mortality and increase the lamb/kid crop (20 participants).

River Valley Small Ruminant Conference, Russellville, AR, April 13, 2024. https://www.uaex.uada.edu/farm-ranch/animals-forages/sheep-goats/small-ruminants-blog/posts/small-ruminant-conference.aspx. This conference was set up to discuss various facets of small ruminant husbandry, such as techniques for improving small ruminant production in Arkansas, breeds and genetic improvement, and gastrointestinal parasite management. Additionally, we had presentations about USDA/FSA programs for small ruminant producers and a producer panel for sharing positive and negative experiences. After the sessions, we had lamb burgers to promote lamb meat (65 participants).

North-Central Arkansas Small Ruminant Conference. Damascus, AR, April 19, 2024. https://www.uaex.uada.edu/farm-ranch/animals-forages/sheep-goats/small-ruminants-blog/posts/4-19-24-conference.aspx. The event covered husbandry, leveraging the expertise of leaders in the field to enhance management practices and increase success. Topics included vaccinations, nutrition, and weaning of the spring lambs/kids, latest research at Dale Bumpers Center and parasite control strategy at the Center, marketing of lambs and goats through farm to table programs, forage production for small ruminants, fecal sampling (how to) and fecal egg counts (50 participants).

Northeast Arkansas Small Ruminant Field Day. Strawberry, AR, May 10, 2024. https://www.uaex.uada.edu/farm-ranch/animals-forages/sheep-goats/small-ruminants-blog/posts/northeast-field-day-2024.aspx. In this field day, producers could have a hands-on experience involving pasture management, nutrition, electric fencing, health management and integrated parasite control (35 participants).

Parasite management webinar. August 12, 2024. This webinar covered basic knowledge about internal parasites and integrated management programs to prevent and control coccidia and gastrointestinal nematode infections. It was broadcast live on @uaex.smallruminant Facebook page and via Zoom. (700 viewers live and 2000 views)

FAMACHA Certification, Perryville, AR, September 21, 2024. https://www.uaex.uada.edu/farm-ranch/animals-forages/sheep-goats/small-ruminants-blog/posts/famacha-certification.aspx. We covered the biology of main parasites, Integrated parasite management, Rational use of anthelmintics(dewormers) and FAffa MAlan CHArt (FAMACHA©) system (25 participants).

Northwest Arkansas Small Ruminant Field Day. Bentonville, AR, November 15, 2024. https://www.uaex.uada.edu/farm-ranch/animals-forages/sheep-goats/small-ruminants-blog/posts/nwa-field-day-nov-2024.aspx. In this event full of demonstrations, producers could experience a deep dive into small ruminant health, reproductive management and nutrition (45 participants).

Central-South Arkansas Small Ruminant Workshop. Sheridan, AR, December 13, 2024. https://www.uaex.uada.edu/farm-ranch/animals-forages/sheep-goats/small-ruminants-blog/posts/south-central-workshop-2024.aspx. This event used a classroom-field hybrid model to cover planning, fences, budget, dairy goat breeds and selection methods and small ruminant basic care (50 participants).

Train-the-trainer

Basic small ruminant training. This course was developed for county extension agents. It consisted of three webinars and one farm visit (19 participants).
Langston University Technical Tour/American Institute for Goat Research & Cheesemaking and soapmaking training. Langston, OK, September 26-28, 2024. This technical tour was focused on train-the-trainer and leadership. The goal was to visit Langston University's dairy goat sector and receive training about cheesemaking and soapmaking. Six UADA Family and Consumer Science Department educators and six producers participated in this tour.
Presentations
In addition to organizing events with invited speakers, Dr. Quadros could give multiple presentations at this and other events:

- Developing the Arkansas Sheep & Goat Advancement Program. Arkansas Farm Bureau - Winter Meeting, January 09, 2024.
- Small ruminant program in Arkansas. American Sheep Industry Association Convention. Denver, January 11, 2024.
- Lambing/Kidding School. Small ruminant workshop – Lambing/Kidding School. Black Rock, AR, January 23, 2024.
- Nutrition for small ruminants: alternative feed sources. 5th Annual Small Ruminant Conference, Starkville, MS, January 24, 2024.
- Nutrition for finishing meat animals and lactating animals. Panhandle Small Ruminant Nutrition Workshop, Quincy, FL, March 12, 2024 (virtual).
- Vaccinations, nutrition, and weaning of the spring lambs/kids. North-Central Arkansas Small Ruminant Conference. Damascus, AR, April 19, 2024.
- Management of metabolic diseases in goats & sheep, especially during pregnancy. Small ruminant production, Virtual Series. Alabama Extension. April 9, 2024.
- Improving small ruminant production in Arkansas. River Valley Small Ruminant Conference, Russellville, AR, April 13, 2024. (state)
- Nutrition, health management and integrated parasite control. Northeast Arkansas Small Ruminant Field Day. Strawberry, AR, May 10, 2024. (state)
- Q&A with Dr. Quadros. Central-South Katahdin Association Gathering & Private Treaty Sale, Fayetteville, AR. May 18, 2024.
- Parasite management. Parasite management webinar. August 12, 2024.
- Sheep & Goat AI introduction. Lincoln High School FFA, August 28, 2024.
- FAMACHA Certification, Perryville, AR, September 21, 2024. (state)
- Q&A Session. Arkansas Goat Festival, Perryville, AR. October 5, 2024.
- Arkansas Small Ruminant Market. AG TECH Meeting. Cadwell Foods, Rosebud, AR. October, 24, 2024.
- Small ruminant nutrition. Northwest Arkansas Small Ruminant Field Day. Bentonville, AR, November 15, 2024.
- Planning. Central-South Arkansas Small Ruminant Workshop. Sheridan, AR, December 13, 2024.

Our communication strategies include diverse media outlets such as Facebook and Instagram social media pages, a blog (https://www.uaex.uada.edu/farm-ranch/animals-forages/sheep-goats/small-ruminants-blog/), newsletter, articles, and interviews published in newspapers, magazines, nonspecialized and specialized websites, as follows:
Jan. 28. Solar grazing draws interest in Arkansas. https://www.arkansasonline.com/news/2024/jan/28/solar-grazing-draws-interest-in-arkansas/
Feb. 2. Panhandle Small Ruminant Nutrition Workshop.

https://nwdistrict.ifas.ufl.edu/phag/2024/02/02/panhandle-small-ruminant-nutrition-workshop-march-12th/
Feb. 15. 5th Annual Small Ruminant Conference at Mississippi State University and funded through SSARE. https://projects.sare.org/information-product/5th-annual-small-ruminant-conference-at-mississippi-state-university-and-funded-through-ssare/
March 12. Panhandle Small Ruminant Nutrition Workshop. https://www.morningagclips.com/panhandle-small-ruminant-nutrition-workshop/
March 15. Recap of the 2024 Panhandle Small Ruminant Nutrition Workshop. https://nwdistrict.ifas.ufl.edu/phag/2024/03/15/recap-of-the-2024-panhandle-small-ruminant-nutrition-workshop/
April 3. CDC confirms bird flu in one person; poultry, ruminant experts warn of avian influenza outbreak. https://www.uaex.uada.edu/media-resources/news/2024/april/04-02-2024-ark-bird-flu-mammals.aspx https://thewynneprogress.com/cdc-confirms-bird-flu-in-one-person-poultry-ruminant-experts-warn-of-avian-influenza-outbreak/ https://www.feedlotmagazine.com/news/industry_news/cdc-confirms-bird-flu-in-one-person-poultry-ruminant-experts-warn-of-avian-influenza-outbreak/article_55b24606-f156-11ee-a67d-333b8499f3c7.html https://www.ed88radio.com/news-2/tag/Poultry+Growers
April 5. Extension to host Small Ruminants Conference for River Valley producers. https://www.uaex.uada.edu/media-resources/news/2024/april/04-05-2024-ark-river-valley-conference.aspx
April 12. Community Briefs April 12. https://www.pbcommercial.com/news/2024/apr/12/community-briefs-april-12/
Nov. 14. Northwest Arkansas small ruminant field day Nov. 15 https://goatrancherupdate.blogspot.com/2024/11/northwest-arkansas-small-ruminant-field.html?m=1
Nov. 16. Small ruminant workshop in Bentonville. https://www.nwaonline.com/news/2024/nov/16/photos-small-ruminant-workshop-in-bentonville/
Nov. 16. BZ FEA RUMINANT DAY 11-16. https://nwamedia.photoshelter.com/image/I0000OvQCYDAirsA
Dec. 11. Small Ruminant Workshop Set For Dec. 13 at Sheridan https://www.clevelandcountyherald.com/news-briefs/small-ruminant-workshop-set-dec-13-sheridan-0
Dec. 15. Bill proposed to allow easier raw milk sales. https://www.arkansasonline.com/news/2024/dec/15/bill-proposed-to-allow-easier-raw-milk-sales/

Dr. Quadros is a member of the American Consortium for Small Ruminant Parasite Control (ACSRPC), part of the Extension Committee, and Chair of the Video Subcommittee. As part of the ACSRPC, I could review the following extension publications:
Glennon, H., 2017, revised and updated by Quadros, D., 2024. Pasture management. ACSRPC Best Management Practices for Internal Parasite Control in Small Ruminants. https://www.wormx.info/_files/ugd/6ef604_dae47e49103341dbb260f69318397cd3.pdf
Luginbuhl, J.M., 2013, reviewed and updated by Quadros, D., 2024. Relatively low-cost, easy "fixes" to decrease gastro-intestinal loads on pastures. https://www.wormx.info/easyfixes
Andries, K., 2013, reviewed and updated by Quadros, D., 2024. Late Summer Parasite Management Strategies in Goat. https://www.wormx.info/andries2013
Thorne, J., 2024, reviewed by Quadros, D., Schoenian, S. Controlling *Haemonchus contortus* in large, extensively managed flocks. ACSRPC Timely topics, June 2024. https://www.wormx.info/_files/ugd/6ef604_fd2316b019c94503b46ec89e0fb4c06e.pdf

Objective 5: Identify producers' challenges and opportunities in marketing goats and goat products

Langston University

Author(s): Carlos Alvarado

Objective: The objective of this initiative was to identify the key challenges and opportunities facing goat producers in marketing their products, including goat meat, milk, and value-added dairy products. By engaging with farmers, conducting market outreach, and providing educational resources, we aimed to support small-scale producers in overcoming barriers and expanding their market potential.

Procedure: Throughout 2024, we conducted multiple outreach events, training sessions, and producer discussions to assess the marketing landscape for goat products. Key activities included:

- **Small Farmers' Conference:** A platform for producers to showcase their goat dairy and meat products, network with potential buyers, and participate in workshops on marketing strategies.
- **Goat Meat Festival:** A major event designed to promote goat meat consumption, introduce consumers to goat-based cuisine, and educate both producers and the public on the benefits of goat meat.
- **Market Research & Product Development:** Supported the exploration of value-added goat products such as goat cheese, yogurt, and soap, including business development strategies for small-scale producers.
- **Producer Surveys & Feedback Sessions:** Conducted surveys to understand pricing challenges, regulatory hurdles, and consumer demand trends in the goat industry.

Results: Our findings highlighted several critical challenges and opportunities:

- **Challenges:**
    - Limited processing infrastructure for goat meat, making it difficult for producers to scale operations.
    - Low consumer awareness and demand for goat dairy and meat in some regions.
    - Regulatory and labeling barriers that complicate product marketing.
    - Difficulty accessing retail markets due to competition with larger dairy and meat industries.
- **Opportunities:**
    - Growing interest in value-added products such as aged goat cheese, yogurt, and goat milk-based skincare items.
    - Rising demand for goat meat within niche consumer groups, including ethnic and health-conscious markets.

- Increased interest in direct-to-consumer sales through farmers' markets, CSAs, and online platforms.
- Potential for cooperative marketing strategies among small farmers to improve market access.

Impact:

- **Market Expansion:** The Small Farmers' Conference and Goat Meat Festival facilitated new connections between producers and consumers, fostering interest in goat-based foods.
- **Entrepreneurial Growth:** Small farmers participating in product development workshops gained insights into expanding their businesses through value-added processing.
- **Consumer Education:** Public outreach efforts, including cooking demonstrations and product tastings, helped raise awareness about goat meat and dairy's nutritional and culinary benefits.
- **Future Development:** The insights gained from producer surveys and market research will inform future initiatives to address key challenges and maximize market potential for goat products.

By identifying these challenges and opportunities, Langston University has taken significant steps toward supporting small-scale goat producers in achieving greater market success. The continued development of educational programs, consumer outreach, and policy advocacy will be essential in driving further growth in the goat industry.

Mississippi State University

Second Kiko Buck Performance Test in Mississippi

Kelsey Mazeres, Caelin Hodges, Ke'Daja Freelon[1], Larry Leon, Maxwell Mkunga, Alex Shook[2], Rhonda Vann, Barbara Roqueto do Reis[3], Leyla Rios

[1]Department of Wildlife, Fisheries, and Aquaculture, Mississippi State, MS, 39762. [2]Pearl River Extension Office; [3]White Sand Research Center, Poplarville, Mississippi State University, 39470, MS.

Objectives: Kikos are a meat goat breed that is growing in popularity in the Southeast, because of their hardiness and resistance to parasites. The objective of this test was to collect data on weaned Kiko bucks grazing a mixture of warm season forages (Crabgrass (*Digitaria sanguinalis*), Switchgrass (*Panicum virgatum*), Bahia grass (*Paspalum notatum*), Carpet grass (*Axonopus affinis*), Dallisgrass (*Paspalum dilatatum*), under commercial farm conditions in Mississippi (MS), from June 2024 to August 2024 (IACUC-24-232).

Procedure: Thirty-five (35) farmers consigned 66 bucks from 13 different states (TX, OK, AR, MO, IL, IN, KY, TN, MS, AL, GA, NC, and WV). Measurements including body weight for calculating the average daily gain (ADG), body condition scoring (BCS), FAMACHA©, and fecal egg count of nematodes (FEC expressed in eggs per gram of feces-EPG), and coccidias (OPG, oocysts per gram of feces), were taken every two weeks. Loin eye area (LA), and loin depth were measured via ultrasound at the beginning and end of the grazing period. USDA grading was also performed by observation of the animals at the same time points. The LA was used to calculate the ratio of LA/BW (REA). The herd was rotated between three paddocks every two weeks, and forage samples were obtained from each paddock for analysis prior to the test. The average crude protein and fiber (acid detergent fiber) of the grasses were 10.55% and 41.23%, respectively. The bucks were dewormed with three classes of anthelmintics upon arrival at the testing site. The 10-week grazing period started after a two-week quarantine period was completed after deworming. The data was analyzed using a Proc Mixed Analysis (SAS, 9.4) to check the effect of the variable (FAMACHA©, BCS, FEC) on BW for a total of 183 observations.

Results: The overall averages for the variables resulted: BW 24.7± 4.6 kg; ADG 19.4 g/d; FAMACHA© 2.5; BCS 2.4; and nematodes 1291.2 EPG. FAMACHA© did not affect BW ($P=0.5651$); BCS affected BW ($P<0.0001$), and higher BCS values were associated with higher BW of the bucks. FEC did not affect BW, ($P=0.8974$). Winning bucks had ADG (g/day) of 58.3 (KY), 51.8 (MS), and 51.8 (GA). Winners for FEC (EPG) had 233.3 (KY), 250 (TN), and 283.3 (KY). The average REA/BW ratio was 1.542 (KY), 1.539 (MS), and 1.506 (IN) for the winning bucks.

Impact: The overall winning buck was from MS. In 2024, MS experienced a very harsh summer with little rain and low grass availability, restricting the animals' normal growth. In the future, a small commercial concentrate supplementation (approx. 250g/animal/day) will be used, for the animal to express their growth potential.

Publications and Collaborations

Fort Valley State University
Publications:
Journal articles**:**
Neha, A., A. Shaik, S.C. Chelkapally, R.S. Kolikapongu, S.C. Namani, T. Erukulla, P. Batchu, N. Mendez, Y. Smith, D. Brown, N.C. Whitley, A.A. Pech-Cervantes, G.S. Dykes, V.R. Owen, G. Kannan, J.E. Miller, A. Siddique, and T.H. Terrill. 2024. Effect of feeding a blackseed meal-sericea lespedeza leaf meal pellet on gastrointestinal nematode and coccidia infection and animal performance in young goats Vet. Parasitol. 331:110253 https://doi.org/10.1016/j.vetpar.2024.110253

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Moawad A. R., Narlagiri R., Kolikapongu R., Henry C., Miller S., Kouakou B., Singh M., Shahat A. M., Whitley N. C., Polejaeva I. A. (2025) 40 Coenzyme Q10 supplementation enhanced dairy goat sperm motility, viability, and acrosome integrity after cooling and cryopreservation. Reproduction, Fertility and Development 37 https://doi.org/10.1071/RDv37n1Ab40

Ramya Sri Kolikapongu, Sharath Chandra Namani, Miller Schauston, Mahipal Singh, Brou Kouakou, Adel R Moawad. Impacts of breeding method on metabolic profile, progesterone concentration, and pregnancy rates in dairy goats. Journal of Animal Science, Volume 102, Issue Supplement_3, September 2024, Pages 169–170, https://doi.org/10.1093/jas/skae234.196

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Other

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Collaborations:
James Miller, retired, Louisiana State University
Felipe Torres-Acosta, Universidad Autónoma de Yucatan Merida, Mexico
Joan Burke, USDA/ARS/DBSFRC, Booneville, AR
Ibukun Ogunade, West Virginia University
Zaira M. Estrada-Reyes, NC A&T State University
Harley Naumann, University of Missouri
Byeng Min, Texas Agrilife
Jim Muir, Texas AgriLife Research & Extension Center, Stephenville
Susan Schoenian, retired, University of Maryland Extension
Dahlia O'Brien, Virginia State University
Stephan Wildeus, Virginia State University
Kwame Matthews, Delaware State University
Moges Woldemeskel, University of Georgia
Sudhanshu Panda, University of North Georgia
Eric Morgan, Queens University, Belfast, Ireland
Andres A. Pech-Cervantes, Prairie View A&M University
Jan van Wyk, University of Pretoria, South Africa
Ibukun M Ogunade, West Virginia University
Multiple FVSU and UGA Cooperative Extension field staff

Mississippi State University

CONFERENCE AND POSTER PRESENTATIONS:

Marchant, N.W., Dlamini, N.H., Kameni, S.L., Feugang, J.M., Rios de Alvarez, L. 2024. A preliminary study of the effect of dietary cottonseed on the follicular reserve of does artificially infected with Haemonchus contortus. Journal of Animal Science, Volume 102, Issue Supplement_1, March 2024, Pages 81–82, https://doi.org/10.1093/jas/skae019.094

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Tennessee State University

Abstracts and Proceedings

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University of Florida

Publications and Collaborations

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Carmona-Flores, L., Wallau, M., Cabrera, C., Vendramini, J. M. B., and Vyas, D. 2024. Evaluating the impact of orange oil and sunn hemp hay on digestibility and anthelmintic efficacy in Texel ewes. *Small Rumin. Res.* 236:107296. https://doi.org/10.1016/j.smallrumres.2024.107296

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Collaborations

USDA, Agricultural Research Service, Booneville, AR

Publications
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Burke, J.M., Rohila, S., Preston, E., Williams, C.C., Scully, C.M., Delcambre, B.A., Petersson, K., Kass, E., Vatta, A., Miller, J.E., Acharya, M., 2025. Viability of feeding *Duddingtonia flagrans* spores in trace mineral mix to lambs for control of gastrointestinal nematodes. Vet. Parasitol. 334, 110114. doi.org/10.1016/j.vetpar.2025.110414

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Nilson, S.M., Burke, J.M., Becker, G.M., Murdoch, B.M., Petersen, J.L., Lewis, R.M., 2024. Genomic diversity of U.S. Katahdin hair sheep. J. Anim. Breed. Gen. 0, 1-11. https://doi.org/10.1111/jbg.12914.

Forbes, R.M., Murphy, T.W., Burke, J.M., Notter, D.R., Spangler, M.L., MacNeil, M.D., Lewis, R.M., 2024. Steps towards including parasite resistance in an economic selection index for hair sheep. J. Anim. Sci. 102, skae327. https://doi.org/10.1093/jas/skae327).

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Virginia State University

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Collaboration

Virginia State University

VSU cooperated with the Virginia Tech, University of Maryland, Fort Valley State University, Delaware State University, Langston University, Tuskegee University, and Florida A&M University in planning and implementing extension and research programs in 2024.

University of Arkansas

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Collaboration with other members/institutions of SCC-81
Joan Burke, USDA/ARS Booneville, AR.
Christine Nieman, USDA/ARS Booneville, AR.