Goat Newsletter

Cooperative Extension Program
Langston University

The Newsletter of the E (Kika) de la Garza American Institute for Goat Research *Summer-Fall 2020*

From the Director's Desk

The COVID pandemic has changed life for many of us and that is true for our university life also. When the pandemic hit back in early Spring, classes moved to an online format and we continue to use a flex option for instructional delivery, research projects were scaled back as the farm crew practiced social distancing, and travel was curtailed. However, the one activity that did not wither but actually flourished was grant writing. Our scientists were able to connect with scientists at other institutions via Zoom meetings and prepare grant proposals. So in this newsletter, I wish to highlight some of our successful grant writing accomplishments.

In the 2018 Farm Bill, legislation required that USDA recognize centers of excellence (CoE) in the agricultural sciences. The CoEs hosted by 1890 Land-Grant Institutions have the goals of: 1) increasing profitability and rural prosperity in underserved farming communities (Small Farms CoE); 2) addressing critical needs for enhanced international training and development (International CoE); and 3) increasing diversity in the science, technology, engineering, agriculture, and mathematics pipeline (Education CoE).

For the Education CoE, Dr. **Nirodha De Silva**, an agriculture economist, was awarded funding for a project entitled "Enhancing Student Recruitment and Workforce Development through Partnerships and Engagements." This project will provide student internships with community-based organizations (CBO) or other such organizations even when the CBO does not have funds to employ the intern. This will provide a great educational opportunity for our students.

For the International CoE, Dr. **Arthur Goetsch** was awarded funding for a project entitled "Targeted Research and Extension Interventions for Enhanced Goat Production in Jamaica." This project will enhance goat production in Jamaica and you can read more about this project on page 2.

For the Small Farms CoE, Dr. **Terry Gipson** was awarded funding for a project entitled "Ranch Commodities, Processes, and Systems: A Small Ruminant Approach." This project will revitalize the eXtension Goat Community of Practice and will provide continuing education opportunities for veterinarians. Langston University, Prairie View A&M University, and the University of Maryland Eastern Shore are partners in this project.

Lastly, the Southern Sustainable Agriculture Research and Education of USDA awarded funding to a large system project entitled "Developing a Sustainable Meat Goat Production and Marketing System for the Southeastern United States through an 1890 Universities Consortium." Dr. **Terry Gipson** will lead this project and you can read more about it on page 4.

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Enhancing Goat Production in Jamaica

The American Institute for Goat Research was recently awarded funding to enhance goat production in Jamaica. Dr. Arthur Goetsch will lead the project and will be assisted by Drs. Terry Gipson and Roger Merkel.

Jamaica is an island country in the Caribbean, is roughly the size of Connecticut, and home to 3 million people.

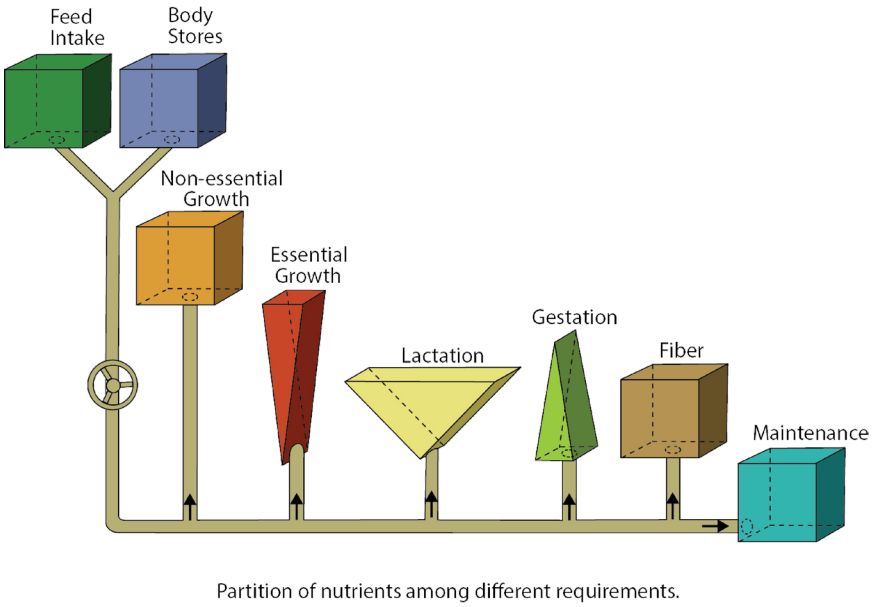
Agriculture in Jamaica supports 20% of the population, but receives little public support, with scant information resources available for training of extension agents and use in providing technical assistance. Most important classes of livestock in the country are chickens and goats, and there is considerable potential for growth of the goat industry. As in other countries, feeding is the major cost of livestock production in Jamaica. There is a wide array of feedstuffs used on goat farms, and capacity for optimal formulation of supplements and diets is hindered by limited laboratory analyses to determine nutritional value. Therefore, objectives of the project are to develop resources, tools, and aids for education of extension agents and use in their training of goat producers and associated businesses; establish standard operating procedures to determine the nutritional quality of feedstuffs and a means to use the information to optimize feeding programs; and evaluate beneficial and preferred management practices through

Inventory of ruminant farm animals in Jamaica (2018).

Species	Number of Head
Cattle	123,724
Goats	574,895
Sheep	1,336

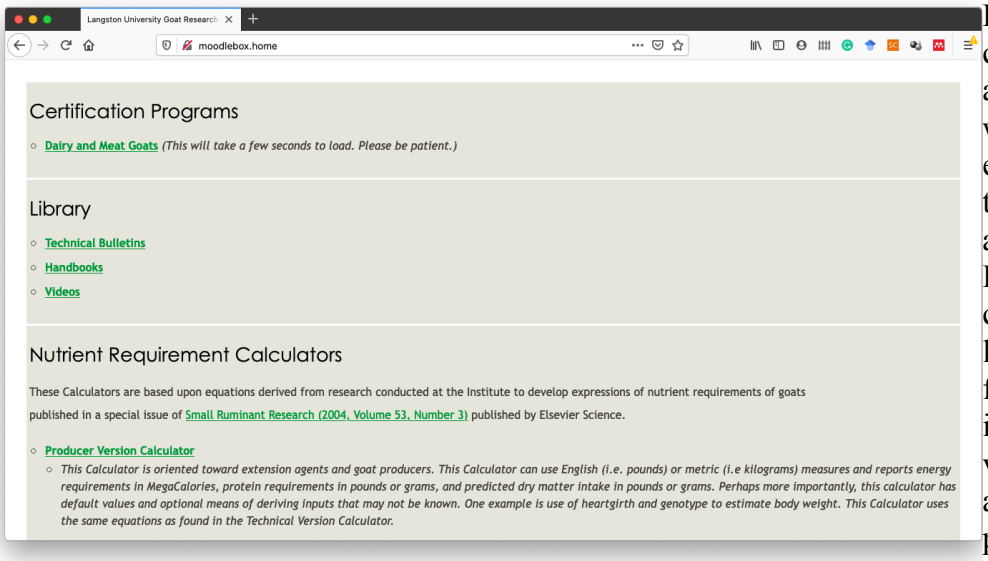
(Source: FAOSTAT)

on-farm research and demonstration activities, inclusive of training in applied research methods. Personnel of Langston University, Virginia State University, the College of Agriculture, Science, and Education (CASE), the Rural Agriculture Development Authority (RADA), and other organizations involved with goat production or product use will work together to identify topics unique to Jamaica for which information resources would lead to increased levels and(or) efficiencies of goat production and economic returns. Then technical bulletins, supplemental videos, and instructional rubrics will be developed and placed on the CASE and RADA websites for access via computer, tablet, and cell phone. The tools will be used to educate extension agents and to train goat producers and associated businesses. Lowest cost and most convenient means of analyzing feedstuff samples for chemical constituents indicative of nutritional value will be identified and standard operating procedures developed.



Partition of nutrients among different requirements.

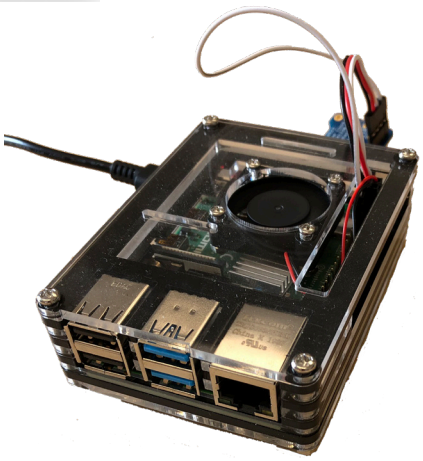
Understanding nutrient requirements is key to providing adequate nutrition for livestock.



Screenshot of prototype home page for the Jamaica project.

Thereafter, a system for determining the nutrient requirements of goats and formulating supplement and diet composition, freely available on the internet, will be installed on small, inexpensive Raspberry Pi 4 computer for use by CASE and RADA personnel and extension agents, along with training in use of the system. To evaluate benefits from employment of best production practices such as most appropriate nutritional management methods, on-farm research and demonstration activities will be conducted, as farmers learn best when observing practices in real-farm settings. This will also provide an opportunity to train CASE and RADA personnel in applied research methods. A conference will be held near the end of the project to summarize findings and address activities to be conducted in a subsequent project.

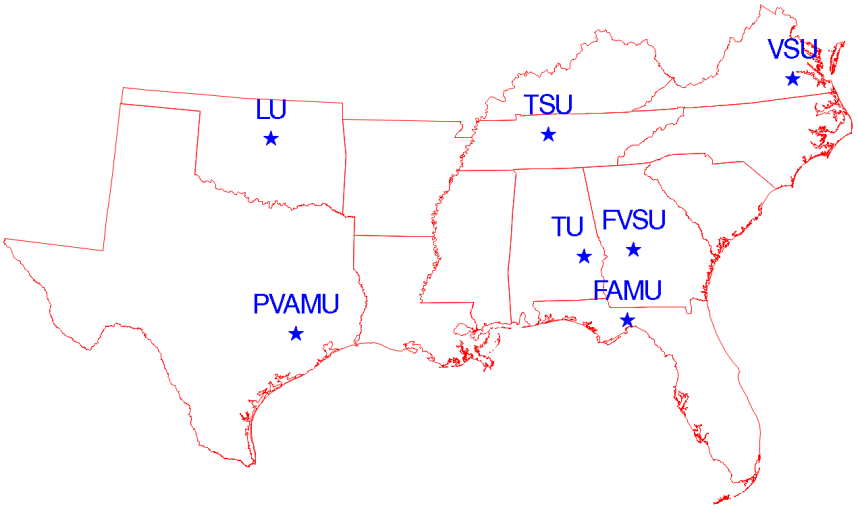
The progress and accomplishments of this project will be highlighted in upcoming newsletters.



The Raspberry Pi is a very low cost, credit-card sized computer that runs on a Debian-based Linux operating system.

Sustainable Meat Goat Production and Marketing

The Sustainable Agriculture Research and Education (SARE) program is a competitive grants and education program and is divided into four different regions that operate as separate entities and run grant programs for their states. The Southern SARE operates in the 13 states represented in the figure to the right.



Langston University (LU) organized a grant-writing consortium consisting of Florida A&M University (FAMU), Fort Valley State University (FVSU), LU, Prairie View A&M University (PVAMU), Tennessee State University (TSU), Tuskegee University (TU), and Virginia State University (VSU). Each of these seven universities belong to the 1890 Land-Grant University system. For the past 40 years, the 1890 Land Grant Universities have been at the forefront of sustaining and promoting the goat industry in the US. Researchers at the participating 1890 universities have dedicated their professional lives to researching of topics impeding the growth of the goat industry in the US and to equipping goat producers with the knowledge, skills, and abilities to become better livestock managers. Institutional commitment in the 1890 Land-Grant Universities to goat research and extension activities is high and these universities will continue to be the vanguard for goat producers in the quest for sustainable and profitable agriculture.

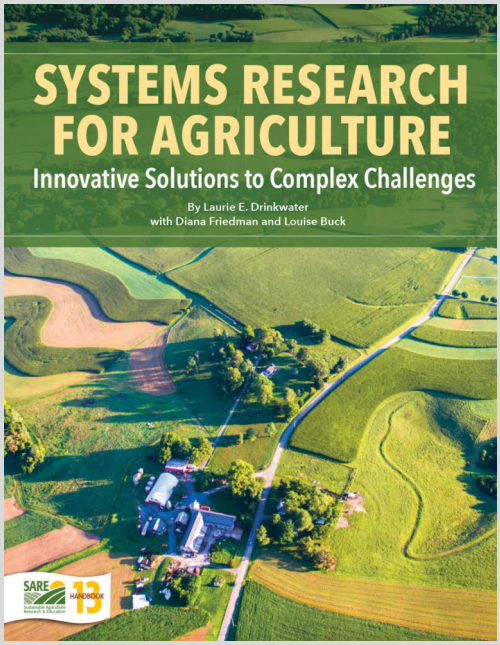
The rationale for the project stated "Generally, a diversified farm is sustainable and resilient and in the southeastern US, meat goat production is a viable option for diversification." This project will create a large systems consortium of 1890 Universities and farmer cooperators to enhance the sustainability of the goat industry and improve economic opportunities for goat producers in the southeastern US.

Specific large system objectives are to:

1. determine factors affecting consumers' preference to purchase and consume goat meat and methods to change those factors (Consumer Preference);
2. assist goat producers in making informed decisions for marketing their goats and goat meat/products (Marketing); and
3. evaluate novel methods of sustainable internal parasite control for raising healthy, productive, and profitable goats (Production).

In this newsletter, the Production goals will be presented and in future newsletters, the Marketing

This extension and research project is based upon a systems approach as outlined in Systems Research for Agriculture (2016) by Laurie E. Drinkwater, Diana Friedman, and Louise Buck. This book is available as a free downloadable pdf or a print version can be purchased for $20 plus shipping (https://www.sare.org/resources/systems-research-for-agriculture/).

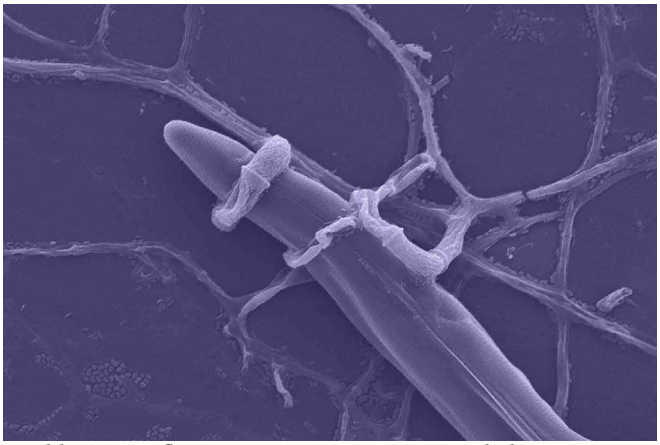


and the Consumer Preference goals will be presented.

In 2015, USDA APHIS reported that 86,701 goats, or almost 1 in 4 nonpredator-caused deaths, died due to internal parasites. *Haemonchus contortus* is the most pathogenic parasite, laying thousands of eggs daily that contaminate pastures and are consumed by goats, resulting is anemia, lost productivity, and even death. Resistance of this worm to chemical dewormers is a worldwide problem. Alternative strategies to chemicals include smart drenching, use of tannin-containing plants, copper oxide wire particles (COWP), selective breeding to increase genetic resistance, pasture rotation, and mixed species grazing. The American Consortium for Small Ruminant Parasite Control website states "15% of the wormiest animals contribute 50% of the total eggs on a pasture and 30% of the wormiest animals contribute 75% of the eggs."

The fungus, *Duddingtonia flagrans*, is a new method of controlling internal parasites that has yielded impressive results in other countries. The fungus has recently been approved for use in the US in a product called "Livamol® with BioWorma®." The fungus 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. As the fungus is naturally occurring, its approval for use in organic production systems should be forthcoming and will be a boon to organic goat farmers, and to the added value that organic goat meat brings in the marketplace. As this is a new product, producers will have questions on its use and cost.

photo courtesy of https://www.premier1supplies.com.



Duddingtonia flagrans entrapping a nematode larva. photo courtesy of https://www.duddingtonia.com.

Production research on endoparasite control has implications across the supply chain and for enhanced consumer demand. Suitable endoparasite control is essential for meat goat enterprise sustainability. Parasites are considered a major constraint to various aspects of goat production. Adequate endoparasite control will, therefore, likely improve output/farm, returns on investment and net profit margin for producers, and efficiency of production. The increase in demand and the consistency of a supply chain by producers, will inevitably lead to a goat marketing channel that is attractive to producers, consumers, and marketing agents.

Therefore, the specific Production goals are to:

1. evaluate potential synergistic effects of *Duddingtonia flagrans* (Livamol® with BioWorma®) and copper oxide wire particles (COWP) in controlling *Haemonchus contortus*, and
2. investigate the selective supplementation of Livamol® with BioWorma®.

These studies utilizing Livamol® with BioWorma® will be conducted in the research herds at each of the seven collaborating universities, as well as in two cooperating farmers' herds in each state. This will be the first wide-scale testing of Livamol® with BioWorma® in the US.

A short, informative video on *Duddingtonia flagrans* can ve found at https://www.youtube.com/watch?v=nFPbzjmNtxs This video describes what *Duddingtonia flarans* is and how it works in the animal ond on the pasture.

World Food Prize Symposium

During the COVID pandemic, many conferences have had to move to a virtual format, which was the case for the renown World Food Prize Symposium 2020. At the American Institute for Goat Research, Drs. Terry Gipson, Arthur Goetsch, Roger Merkel, and Yoko Tsukahara attended the virtual World Food Prize Symposium, which was held from October 12 to 16. The symposium addressed the importance of soil health and rightly awarded Dr. Rattan Lal, an Ohio State University soil scientist, the World Food Prize. The laureate emphasized the importance of soil health in food systems with his premise of "the health of soil, plants, animals, people and the environment is one and indivisible." Fertilizing with nitrogen, phosphorus, and potassium is a common practice in field crops but little attention is paid to lost soil organic matter, he says. At the symposium, international leaders and stakeholders in agriculture discussed the issues, solutions, hopes, actions, and future of food systems around the globe. In the same week that the World Food Prize took place, the International Day of Rural Women (October 15) and the World Food Day (October 16) were also celebrated. Relatedly, the Nobel Peace Prize 2020 was awarded to the World Food Programme of the United Nations highlighting their efforts to end global hunger, especially in peoples displaced by instability, insecurity and conflict. Some of the symposium sessions can be seen on the World Food Prize's YouTube channel (https://www.youtube.com/user/WorldFoodPrize/playlists).

Drs. Merkel. Gipson, Tsukahara, and Goetsch (l to r) listen to the awards ceremony of the 2020 World Food Prize.

One speaker who I enjoyed was this year's laureate, Dr. Rattan Lal. Throughout 2020, the world has seen how interconnected it is; how human health in one part of the world impacts everyone. Dr. Lal's approach that the health of all things, from soil to people, is connected resonated with me. The soil, animals, plants, and people all depend on the same thing - a healthy environment. We, as humans, can control how we care for the environment and maintain it for future generations.

- Roger Merkel

For me, the presentation with the greatest WOW factor was the panel discussion on artificial intelligence in agriculture. One of the panel presenters was Dr. Molly Brown of 6th Grain, a digital technology company which focuses on big data and machine learning. 6th Grain is using Android smartphones in sub-Saharan Africa to combine farmer-generated data with satellite and weather information to deliver crucial information to the farmer. This thousand-points-of-light approach to big data is truly an impressive feat.

- Terry Gipson

The most impressive thing for me was that people of different backgrounds were at the same table for discussions, such as former Vice President Al Gore, scientists, economists, farmers, and even high school students. Among these panelists, I agreed with Ms. Ismahane A. Elouafi, Director General, International Center for Biosaline Agriculture, Dubai, UAE. She proposed systematic changes in the value chain and food systems for environment and equity, focusing on local production and consumption. The current system is obviously not good for the planet or the poor, she said.

- Yoko Tsukahara

A session that I found very informative was about the Food Systems Dashboard, which was led by Dr. Lawrence Haddad and Dr. Jessica Fanzo. Food systems of over 230 countries and territories are characterized by food supply chains, food environments, individual factors such as economic, consumer behavior, and diets. An example of potential usage from the Dashboard website is viewing of country-level data about intake of fruits, vegetables, and whole grains, as well as nutrition and health outcomes such as high blood pressure, which may indicate a correlation between lower intakes of these nutritious foods and a higher prevalence of high blood pressure.

- Arthur Goetsch

Research Spotlight

Genes Identified in Parasite Resistance.

Gastrointestinal nematode infection is the most important disease affecting the small ruminant industry in U.S. The environmental conditions in the southern United States are ideal for the survival of the most pathogenic gastrointestinal nematode, *Haemonchus contortus*. Host genetic variation for resistance to *H. contortus* allows selective breeding for increased resistance of animals. This selection process increases the prevalence of particular alleles in sheep and goats and creates unique genetic patterns in the genome of these species. The aim of this study was to identify loci with divergent allelic frequencies in a candidate gene panel of 100 genes using two different approaches to estimate F_{st} outliers in three different breeds of sheep and goats exposed to *H. contortus*. Our results for sheep populations showed SNPs under selection in C3AR1, CSF3, SOCS2, NOS2, STAT5B, TGFB2 and IL2RA genes. For goats, SNPs in CD1D, ITGA9, IL12A, IL13RA1, CD86 and TGFB2 genes were under selection. Common signatures of selection in both species were observed in NOS2, TGFB2 and TLR4 genes. Directional selection was present in all SNPs evaluated in the present study. A total of 13 SNPs within 7 genes of our candidate gene panel related to *H. contortus* exposure were identified under selection in sheep populations. For goats, 11 SNPs within 7 genes were identified under selection. Results from this study support the hypothesis that resistance to *H. contortus* is likely to be controlled by many loci. Shared signatures of selection related to mechanisms of immune protection against *H. contortus* infection in sheep and goats could be useful targets in breeding programs aimed to produce resistant animals with low FEC.

Estrada-Reyes, Z. M., Y. Tsukahara, R. R. Amadeu, A. L. Goetsch, T. A. Gipson, T. Sahlu, R. Puchala, Z. Wang, S. P. Hart, and R. G. Mateescu. 2019. Signatures of selection for resistance to Haemonchus contortus in sheep and goats. BMC Genomics 20:735. https://doi.org/10.1186/s12864-019-6150-y.

Immune Response to Parasite Exposure.

Haemonchus contortus infections are an important source of animal production loss to livestock industry. Genetics of helminth resistance involves a complex set of factors related to the host immune response. The aims of this study were: (1) to use a targeted sequencing approach to identify SNPs in 100 genes related to immune response during *Haemonchus contortus* exposure in growing males of St. Croix, Katahdin and Dorper sheep, and in Kiko, Boer and Spanish goats, and (2) to perform an association analysis for fecal egg count (FEC), packed cell volume (PCV), immunoglobulin levels (IgA, IgG and IgM) and average daily gain (ADG) in the populations under study. After quality control, 1,356 SNPs (sheep) and 1,029 SNPs (goats) were used for the association analysis. For sheep, SNPs located on OAR1 (42487870, 42489606) and OAR2 (192231080, 26321541) were significantly associated with IgM, ADG, and FEC. For goats, SNPs on CHR3 (42898132) and CHR22 (23066762) were associated with ADG and IgM. In both species, no significant associations were found for IgA, IgG and PCV. The results from this study revealed genes involved in the immune response to *H. contortus* exposure and provide additional SNP marker information that has potential to aid selection of resistance to gastrointestinal parasites in sheep and goats from different breeds. Significant SNPs within IL12RB2, NFIL3 and STAT4 genes could be potential markers for IgM, FEC and ADG in sheep populations. For goats, potential markers for IgM and ADG were identified within IL5RA and IL12RB2 genes. These results could be directly implemented in the populations used in this study, however, they should be validated before using these markers in other sheep and goat populations.

Estrada-Reyes, Z. M., Y. Tsukahara, A. L. Goetsch, T. A. Gipson, T. Sahlu, R. Puchala, and R. G. Mateescu. 2019. Association analysis of immune response loci related to Haemonchus contortus exposure in sheep and goats using a targeted approach. Livestock Science 228:109-119.

Editor's Note: The research for both of these manuscripts was made possible from funding from a USDA/NIFA project #OKLXSAHLU12 entitled "Sustainable Small Ruminant Production through Selection for Resistance to Internal Parasites"

Noteworthy News

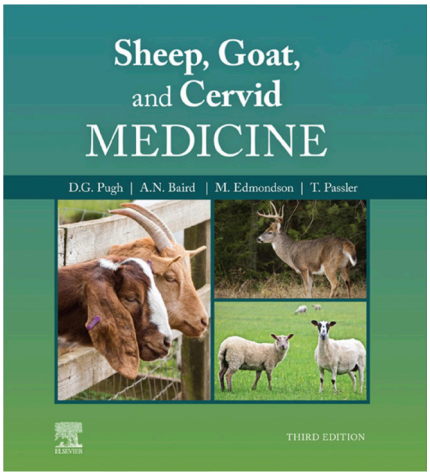
►In July, Dr. **Roger Merkel** gave an invited presentation via Zoom on Mortality Composting for a Webinar Series conducted by the Agricultural Training Institute, International Training Center for Pig Husbandry, Lipa City, Philippines.

►In July, Drs. **Terry Gipson**, **Arthur Goetsch**, **Raquel Lourencon**, **Luana Ribeiro**, **Ryszard Puchala**, **Yoko Tsukahara**, and **Wei Wang** presented research findings and attended scientific sessions of the virtual national meetings of the American Society of Animal Science.

►In October, Dr. **Roger Merkel** gave an invited presentation via Zoom on Feed Alternatives to Antimicrobials for the 5th International Livestock Biotechnology Symposium, "Research-driven Innovations Addressing and Mitigating the Impacts of Global Pandemic in the Livestock Industry" conducted by the Livestock Biotechnology Center, National Research Council of the Philippines.

►In October, Drs. **Tilahun Sahlu** and **Yoko Tsukahara** attended the International Goat Association Board meeting via Zoom and discussed issues and updates on International Conference on Goats 2021 in Eger, Hungary, Regional Conferences, Small Ruminant Research, and other business items.

►In 2020, Drs. **Lionel Dawson** and **Roger Merkel** coauthored a chapter on Herd and Flock Health that was published in the third edition of Sheep, Goat, and Cervid Medicine. The full citation is Dawson, L. J., C. F. Shipley, R. Merkel, and D. G. Pugh. 2020. Herd and flock health. In: Sheep, Goat, and Cervid Medicine. Third



*Editor's Note: This book is available at Amazon.com (*https://www.amazon.com/Sheep-Goat-Cervid-Medicine-David/dp/0323624634/ref=asc_df_0323624634*) and* ***not*** *through Langston University.*

Ed. D. G. Pugh, A. N. Baird, M. Edmondson, and T. Passler (eds.). Elsevier, Inc. Pp. 479–498.

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