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Dearborn, L.¹, Lemus, R.², Pesato, M.³, and Rios, L.⁴

¹Graduate Student, Department of Animal & Dairy Sciences, Mississippi State University, Mississippi State, Mississippi, USA, Mississippi State, Mississippi, 39762

²Extension Forage Specialist, Department of Plant and Soil Sciences, Mississippi State University, Mississippi State, Mississippi, USA, Mississippi State, Mississippi, 39762

³DVM, DABVP (Food Animal Practice), Four State Veterinary Services. P.O. Box 241, Bear, Delaware, USA, Bear, Delaware, 19901

⁴Extension Specialist-Small Ruminant, Department of Animal & Dairy Sciences, Mississippi State University, Mississippi State, Mississippi, USA, Mississippi State, Mississippi, 39762

Assessment of Small Ruminant Production Systems in Mississippi and the Southeastern USA using an Online Survey

Abstract

This study examines demographics, management, and health practices of small ruminant production systems (SRPS) in Mississippi and the southeastern U.S. using survey data from 216 producers (2021–2022). Respondents were predominantly female (54.6%), younger than average U.S. farmers, and highly educated. Key practices such as FAMACHA© scoring, vaccination, and rotational grazing were widely adopted. Gaps in animal management were evident, including limited animal weighing, key to possible compromised parasite control, and poor performance monitoring. Gastrointestinal parasitism was a major health concern. Findings highlight the need for targeted Extension education on sustainable parasite, record-keeping, and herd health practices.

Keywords: sheep; goats; grazing; parasites; management

Introduction

The United States Department of Agriculture reported a slight increase in the number of sheep and goats in 2026, with a total of 5.05 million head of sheep and lambs and 2.51 million head of goats and kids recorded in the nationwide inventory for both species (USDA-NASS, 2026). For Mississippi (MS), also decreasing numbers have been reported: 18,000 heads currently (USDA, 2025), compared to 30,153 goats in 2022, for sheep and lambs, 18,884 heads were reported in the 2022 census (USDA, 2022).

As of 2022, 17.4% of the MS workforce reportedly works directly or indirectly in agriculture (MDAC, 2022). This affirms MS's reputation as an important player in animal agriculture nationwide. Sheep and goats have the potential to be a source of economic growth and vitality for rural communities across the state. However, there is a lack of current literature and statistical data reporting the demographic and managerial statuses of small ruminant farms in MS and the southern USA. This lack of farmer-level data limits the scope of state- and region-wide programs designed to support small ruminant production systems (SRPS) in areas such as parasite control, animal health, grazing management, marketing, profitability, and rural sustainability. The online *Small Ruminant Production Survey* was thoughtfully designed to yield novel data essential not only to understanding and developing efficient small ruminant production operations in the Southeast U.S., but also to assessing their potential impact on the region and the sheep and goat industry.

Methods

The *Small Ruminant Production Survey* was developed using QualtricsXM (Silver LKW, Seattle, WA), an online survey-building platform. The survey was developed with the advice of many departments at Mississippi State University, including faculty in Animal & Dairy Sciences, Plant & Soil Sciences, the School of Human Sciences, the Social Science Research Center, the Department of Agricultural Economics, the College of Veterinary Medicine, and the Academic Advising Center. The survey was approved by the Office of Research Compliance and the Human Research Protection Program

(HRPP) under protocol IRB-21-202. The questions from the online survey included in this study concern the farmer's gender, age, race, and education level. Regarding animals and farm practices, questions covered species, breeds, body weights, primary health issues, vaccinations, dewormers used on the farm, deworming frequency, deworming criteria, forage, grazing management, and extension education (questions are included in the appendix). Responses were collected via an anonymous survey from September 10, 2021, through September 8, 2022, and participants could opt out of any question at any time during the response process. The survey was administered exclusively online via a single URL, with no paper copies. Participants obtained the survey link/QR code via email, social media (Facebook and Instagram), the Mississippi Sheep & Goat Associations, or the Mississippi State University Extension events, such as Producer Advisory meetings or invited farm visits/outreach by Extension personnel.

Descriptive statistics:

Maximum value, minimum value, mean, median, standard deviation, and coefficient of variation were determined for each question. Knowledge of the value distribution was obtained by constructing frequency distributions for each question's alternatives, facilitating visual interpretation with graphs based on these distributions. The independence of answers across questions was tested using the χ^2 test (comparing every pair of alternatives across questions, yielding 5253 tests) to determine whether an answer in one question could be conditioned on an answer in another. The statistical significance of each χ^2 test was set at 0.01% ($P < 0.01$).

Results

The majority of the survey responses (N = 141, 64.86%) were from participants in Mississippi (MS). In comparison, the rest of the responses originated in Tennessee (9.46%), Alabama (6.31%), North Carolina (3.15%), Kentucky (2.70%), Florida (1.80%), Georgia (2.70%), Louisiana (1.80%), Oklahoma (2.25%), Texas (2.25%), Arkansas (1.80%), and Virginia (0.45%).

Small Ruminant Producer Demographics

Gender – Two hundred and sixteen (216) participants reported their gender identity; 54.6% (n=118) were female, 44.4% (n=96) were male, 0.5% (n=1) identified as non-binary/third, and 0.5% (n=1) preferred not to say.

Age –The average age of survey participants was 47.6 years. The median age was 49 years, with a range of 16 years (minimum) to 79 years (maximum). MS producers were strongly associated with the responses of 25- and 56-year-olds ($P < 0.01$), as determined by the Chi-square test.

Race – Ninety-six percent (96%) of participants identified as *non-Hispanic or Latino*, 2% identified as *Hispanic or Latino*, and 1% preferred not to indicate their ethnicity. In terms of racial demographics, 90% of participants identified as *White*, 3% identified as *African American*, 3% selected *American Indian or Alaskan Native*, 0.5% selected *Asian*, 0.5% selected *Native Hawaiian or Other Pacific Islander*, 1% selected *Other*, and 2% of participants preferred not to indicate their ethnicity.

Education level – No participants reported an education level below *high school* completion. Twenty percent (20%) finished High school, twenty-four percent (24%) hold an *associate degree*, 25% hold a *bachelor's degree*, and 21% hold a *postgraduate degree*. Five percent (5%) of respondents who selected *other* reported having completed some college. The remaining 2% indicated that their level of education was *years of trade school*. These results demonstrate that a majority of small ruminant

producers in the southern USA are college-educated or college-equivalent, and that they also had greater access to the online survey. Producers from Arkansas, Florida, and MS indicated having an associate degree ($P<0.01$). In contrast, producers from Louisiana had a bachelor's degree ($P<0.01$), and those from Oklahoma had a *high school degree* ($P<0.01$). On the other hand, MS producers had a *bachelor's degree* ($P=0.01$), and those from Georgia reported postgraduate studies ($P=0.01$).

Animals

Species and Breeds – 81% of participants indicated that they have goats, 35% have beef cattle, 29% have sheep, 28% have horses, 25% have poultry, 7.5% have swine, and 4% have dairy cattle. Among small ruminant breeds, Kiko goats were the most common, selected by 17.8% of participants (Figure 1), followed by *Crossbred* goats at 13.3%, with Boer goats in third at 11.5%. For sheep breeds, *Katahdin* was the most selected at 9.1%, with *Dorper* being the second most common sheep breed at 4.2%. Notably, a significant portion (7.3%) of producers reported having "other" sheep or goat breeds not listed in the survey options.

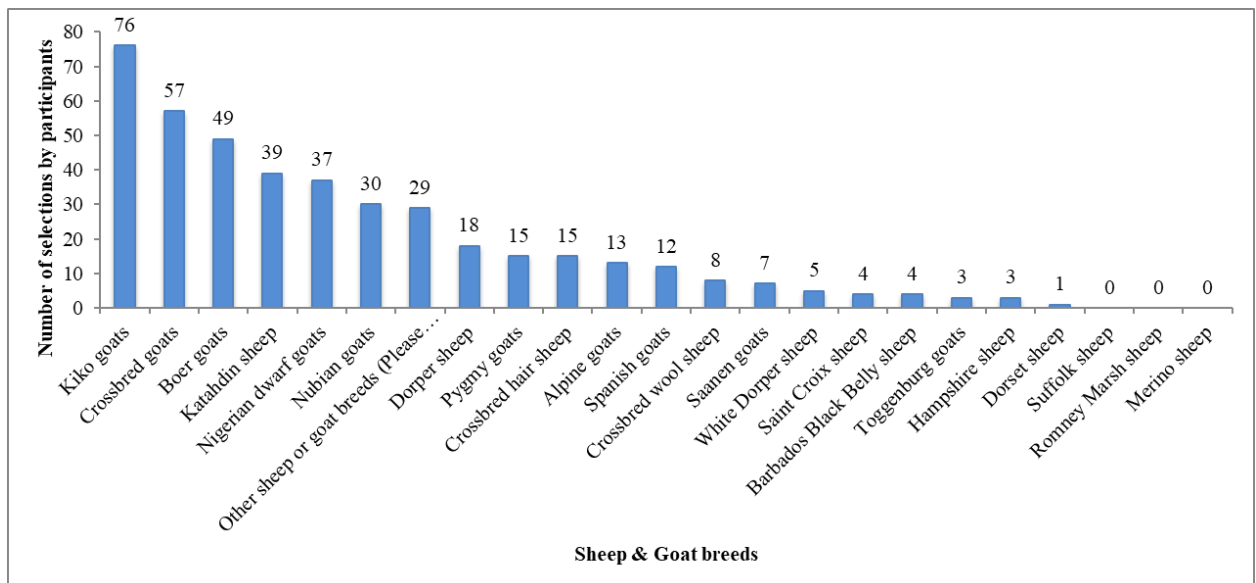


Figure 1. Distribution of responses to small ruminant breeds across participating farms.

Animal Performance

Body Weights – A concerning 31% of producers *never weigh their animals*, indicating a complete lack of performance monitoring. Only 16% of producers *weigh their animals monthly*, suggesting a limited understanding of the importance of regular weight assessment. Producers in North Carolina and Kentucky weigh their animals more frequently ($P=0.01$), whereas those in North Carolina and Oklahoma weigh them *bimonthly* ($P<0.01$). Producers in Florida and North Carolina were also associated with the answer *that they never weigh their animals* ($P=0.01$).

Farm practices – This provides valuable insights into the current state of animal care and health practices among sheep and goat producers in the Southeast U.S. *Hoof trimming* and *FAMACHA® scoring* are the most widely adopted practices, with adoption rates of 88% and 82%, respectively (Figure 2). MS farmers were associated with health practices such as *hoof trimming*, *BCS evaluation*, *FAMACHA® scoring*, *castration*, *footbath*, and *dehorning/debudding* ($P<0.01$).

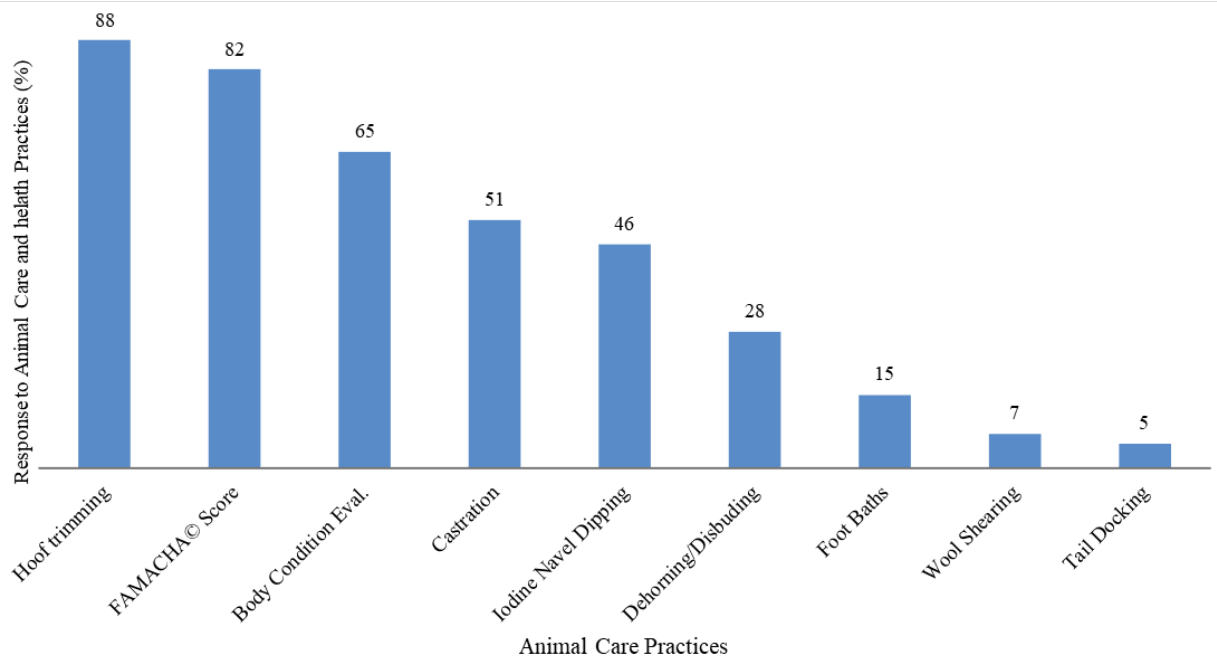


Figure 2. Percent of participants who implement animal care and health practices in their SRPS.

Health Management

Primary Health Issues – A strong association was found across states between *foot disease/lameness* and SRPS overall health status (Figure 3). Producers in MS reported a higher incidence of *coughing animals* ($P<0.01$), as well as issues with *foot disease/lameness*, *parasitism* (*pale eye mucous, diarrhea, weight loss*), *mastitis*, and *pneumonia* ($P=0.01$). Tennessee reported that the primary health issue was parasitism (*pale eyelids on FAMACHA© score, diarrhea, weight loss*) ($P<0.01$), likely due to warm, humid climates that favor parasite development and transmission. All states *answered that foot disease/lameness* was the main health issue ($P<0.01$).

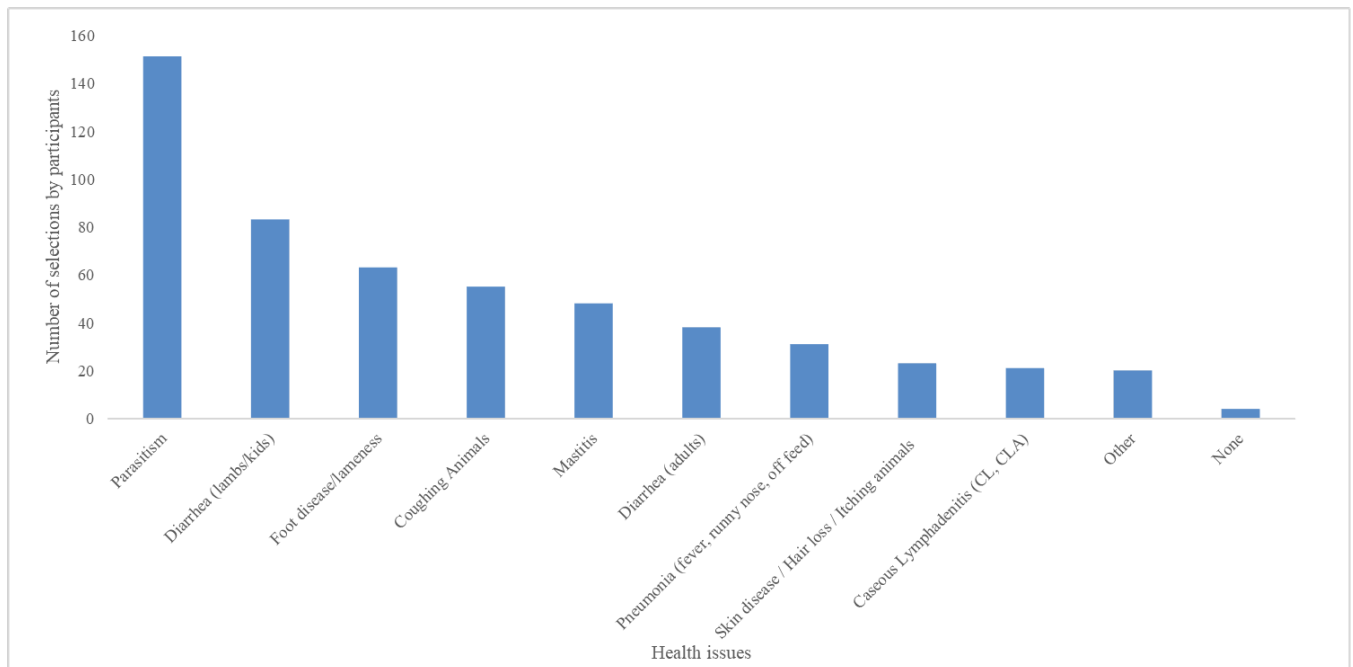


Figure 3. Distribution of responses to animal health issues that producers face with small ruminants in their farms.

Vaccinations – Data indicate that 94% of Southeast SRPS producers vaccinate their sheep and goats, whereas only 6% do not. Vaccination programs indicate that CD+T is the most selected vaccine among participants (73%), followed by the 8-way clostridial

with tetanus (17%). Tennessee is the only state in which a clear preference for CD+T is evident ($P = 0.00$). The widespread use of CD+T suggests that producers in the Southeast are primarily concerned with preventing diseases caused by *Clostridium perfringens* types C and D, as well as tetanus. The cost of different vaccines and the perceived value of protection against specific diseases may also influence farmers' decisions, potentially affecting the frequency and timing of vaccination.

Parasite Control

Dewormers used on the farm – Participants revealed a wide range of dewormers and combinations, including both conventional and alternative options (Figure 4).

Albendazole (Valbazen) and *Levamisole (Prohibit)* were the most commonly selected dewormers. A small but significant portion of participants (3.5%) are opting not to use dewormers, potentially to mitigate anthelmintic resistance. For all states, most of the options were selected ($P < 0.01$) including *Moxidectin (Cydectin sheep drench orally)*, *Albendazole (Valbazen)*, *pour-on cattle dewormer given topically on skin (Eprinex, Cydectin, Ivomec)*, *combinations or other*, *Fenbendazole oral liquid (Panacur, Safe-Guard)*, *Levamisole (Prohibit)*, *Ivermectin (Ivomec) cattle/swine injectable given orally*, *Ivermectin (Ivomec) cattle/swine injectable given under the skin*, *horse dewormer (Zimectrin Gold, Equimax)*, *Fenbendazole (Safe-Guard) pellets in feed*. In addition to these multiple choices across all states, MS producers selected *combinations or other* dewormers ($P = 0.01$), suggesting that MS farmers may be more likely to use unique or mixed dewormer strategies.

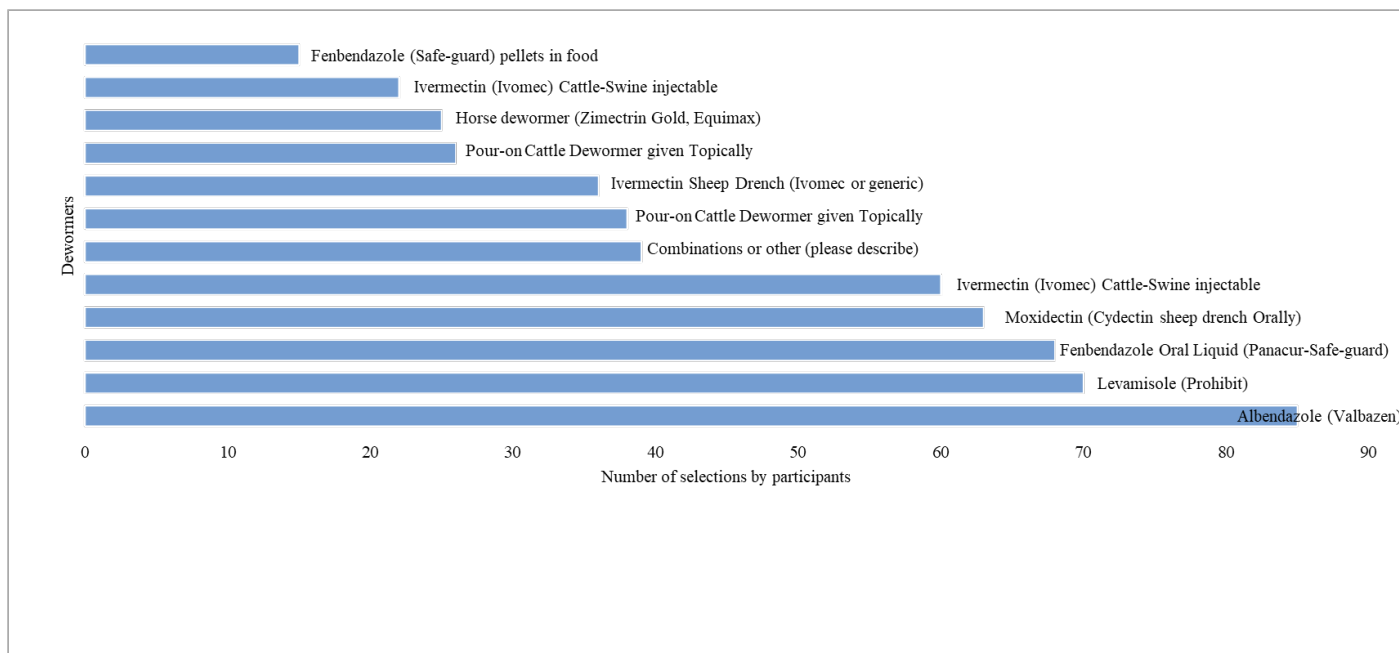


Figure 4. Distribution of responses to common dewormers used on small ruminants by participants in their farms.

Frequency of deworming – Fifty-three percent (53%) of participants indicated that they implement 2-3 dewormers each year, whereas 27% deworm their animals once annually, twelve percent (12%) of participants indicated 4 to 6 dewormings per year, and 7% selected 6+ deworming sessions each year. One deworming per year was significantly associated with MS and Louisiana producers ($P < 0.01$), and 2-3 dewormings per year were significantly associated with Oklahoma farmers ($P < 0.01$) and Kentucky producers ($P = 0.01$).

Deworming criteria – Figure 5 shows that the most used criteria for deworming small ruminants were BCS (26.9%), followed by the FAMACHA[®] score (20.1%), bottle jaw (12.3%), and diarrhea (10.1%). These criteria encompass approximately 60% of the choices. Responses indicated that 5.1% of producers continue the practice of "blanket deworming" (all the herd/flock dewormed at the same time). "Other" reported deworming criteria included deworming shortly after kidding/lambing; confirming parasites/worms in feces; deworming before times of stress, weaning, a new goat on the farm, ova and parasite examination, hair condition, and before breeding. A

relationship ($P < 0.01$) was found among producers across all states included in this study and the use of these criteria: all *the herd/flock dewormed at the same time*, use of *FAMACHA® Score*, *low weight gain*, *BCS of the animal*, *bottle jaw*, *diarrhea*, *season of the year*, and *fecal egg counts submitted to the lab (McMaster slide)*. In Tennessee, a significant association was found between *the FAMACHA® score and BCS* ($P < 0.01$), whereas *MS farmers were associated with the FAMACHA® score and bottle jaw* ($P = 0.01$). Producers in Louisiana were found to have a strong association ($P = 0.01$) between *not weighing their animals before deworming*.

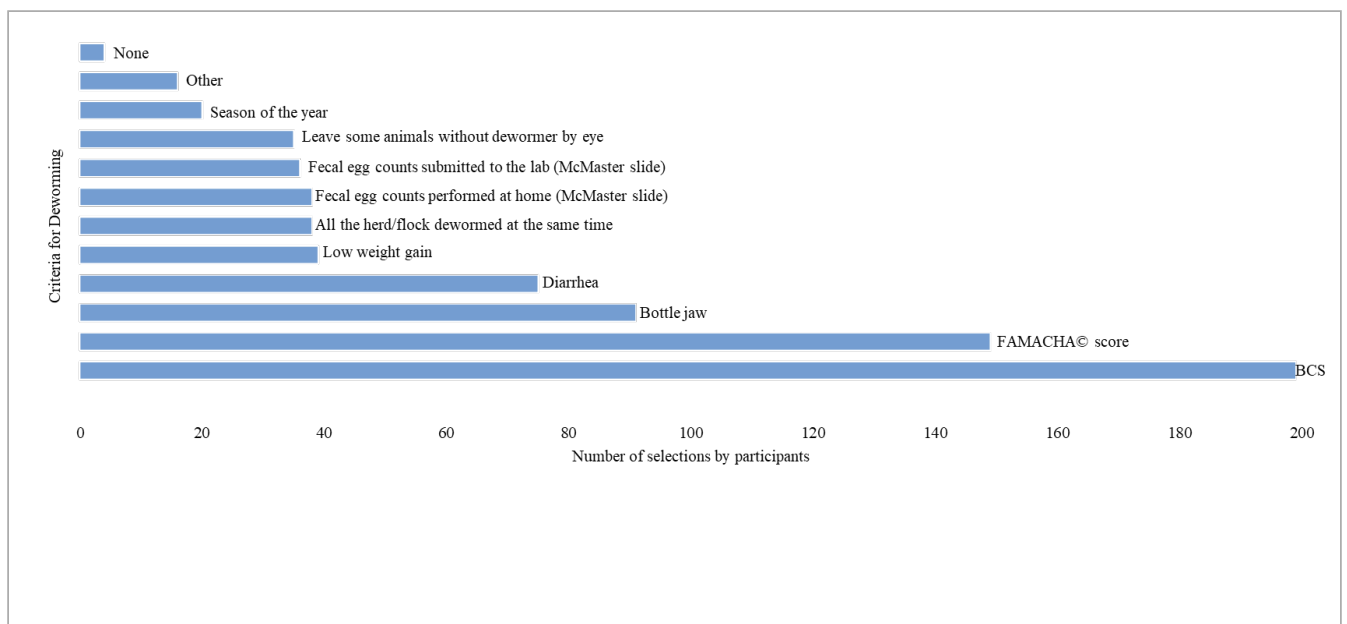


Figure 5. Distribution of responses to the criteria used by farmers to deworm small ruminants in their farms.

Forages and Grazing Management

Forages – The Southeast's diverse climate and soil conditions support a wide and rich variety of forages. Producers reported a grass mix (62%), predominantly warm- and cool-season grasses. Winter annual cool-season grasses (especially annual ryegrass [*Lolium multiflorum*]) dominated 53% of the winter grazing and forage production in the Southeast. "Other forages" was a category that farmers could fill in, including browse

(trees and shrubs), general brush (small trees), and pine trees (a major component of southeastern landscapes).

Grazing management – A significant majority (85%) of SRPS in the Southeast utilize rotational grazing, indicating a strong awareness of its benefits. A notable portion (15%) does not rotate pastures, likely due to limited land or specific grazing strategies. A wide range of rotation periods and methods is employed, reflecting variations in farm size, management style, and environmental conditions. Responses indicated that MS and Georgia have a higher incidence of continuous grazing. The most reported rotation periods are 21 days (29%) and 7 days (8%) for paddock utilization. On the other hand, regarding grazing methods. A small percentage of producers (8%) opt for a highly frequent rotation, changing pastures every 7 days. Some (5%) rotate every 10 days, a smaller group (2%) every 3 days, and a few producers (7%) rotate monthly. A considerable number of producers (27%) use mixed-species grazing. Producers in MS tend to favor *continuous grazing (only 1 paddock for all animals)* and *mixed plant species grazing (more than one species per paddock)* ($P<0.01$). Also, Georgia and Oklahoma farmers chose *continuous grazing (only 1 paddock for all animals)* ($P=0.01$).

Extension Education

Participants, on average, selected 5-6 relevant topics, indicating a broad range of educational interests (Figure 6). A significant majority (78%) of participants expressed interest in *small ruminant parasite control*. Other important topics were herd health, forage selection, grazing management, supplementation, genetic improvement, and reproductive management. Beyond the core topics, participants selected as *Other: milk production, native forage management, toxic plant management, udder health, and invasive plant eradication*. While there were common topics across states, producers from all states (except Florida) identified a specific set of needs: *parasite control, herd health, forage selection, and grazing management* ($P<0.01$).

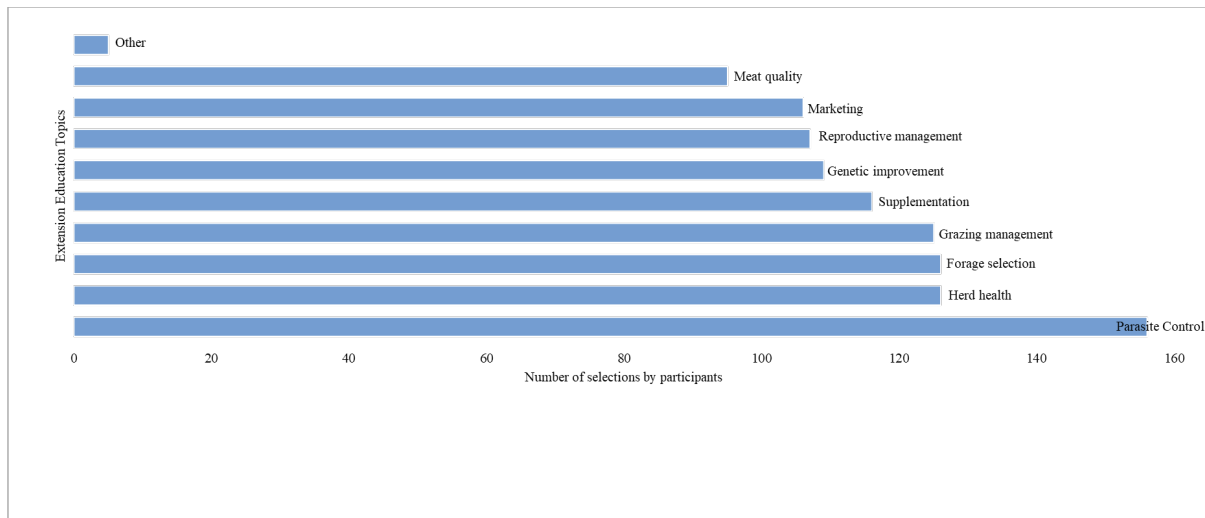


Figure 6. Distribution of responses to the Extension Education topics chosen by farmers

Discussion

The results presented here reveal previously unknown key factors related to the farmers in the Southeastern United States, small ruminant breeds used, animal performance, farm management, and health. In 2017, female producers accounted for 36% of agricultural producers in the United States (USDA, 2017). Trends towards women entering the agricultural industry align with survey results. Another key finding of the survey is that the mean age of participants is 47 years. The average age of farmers in Mississippi was 58 years in 2017, only 1 year above the national average of 57 years. The survey participants' average age may indicate a shift toward younger individuals entering small ruminant production in the southeastern United States. A 2022 survey of 636 sheep and goat farmers in the U.S. found that 62.7% were women, 33.3% were men, and nearly 60% were aged 30 to 59 years, indicating that young farmers were also represented in this industry (Whaley et al., 2022).

In terms of breed popularity, *responses to the Small Ruminant Production Survey* indicated that Kiko goats and Katahdin sheep are the most commonly owned breeds among survey participants. Kiko goats have been a popular breed choice for meat goat

producers in the United States since the late 20th century and are known for natural parasite resistance, overall hardiness, and desirable carcass characteristics (Gipson, 2019; Murphy, 2016). Katahdin hair sheep, as well as other hair sheep breeds, are growing in popularity as well (The Livestock Conservancy, 2026). Notable for their heat and parasite resistance, hair sheep are excellent candidates for the climate and parasite burden facing the Southeastern United States SRPS (Notter et al., 2017; Tadesse et al., 2021; Thorne et al., 2021).

Parasitism was the most frequently selected health concern, with 78% of participants reporting it as an issue of high impact. The reported prevalence of parasitism infection is consistent across the literature (Quadros & Burke, 2024; Zajac & Garza, 2020), and this survey. The traditional way to control gastrointestinal parasites is deworming with commercial anthelmintics, but to properly dose the animals, farmers need to weigh them. The American Consortium for Small Ruminant Parasite Control (ACSRPC) provides numerous useful fact sheets and infographics on its website (www.wormx.info) that describe the proper and safe methods for deworming sheep and goats (Schoenian, 2024). Regular animal weighing is also essential for accurately assessing growth rates, feed efficiency, and overall health. The survey reveals a significant gap in the regular weighing of animals among SRPS producers, which could, in the short term, lead to inadequate monitoring of animal performance and errors in deworming, increasing resistance in the worm population to commercial dewormers.

The most relevant extension topics found in the current study were parasite control, herd health, forage selection, and grazing management. Similarly, Whaley et al. (2022) report that parasite management was the main topic of interest for farmers, independent of region, followed by general animal health practices, breeding stock nutrition, and reproductive management. Although only 216 responses were received to this survey, they undoubtedly provide insight into the lives of SRPS in the southeastern United States. Addressing the needs of SRPS producers is vital to the success and impact potential of Extension and educational programming. To address some shortcomings of this study, future surveys encompassing known and novel topics should be available to

a larger number of participants, using both online and in person or written format, so a wider diversity of farmers is addressed and consulted, including those with less social media engagement or lower digital literacy, especially in those located in the rural areas. Finally, since 65% of participants are from Mississippi, we should make greater efforts to obtain additional responses from other states in the Southeastern United States.

Conclusion

This study provides novel insights into the demographic characteristics, features of small-ruminant farms, and management practices in MS and some Southeastern states. Leading to ideas on potential educational needs for small ruminant extension programs in the region. Survey responses suggest increased participation by younger and female producers in the small ruminant industry, as well as widespread adoption of breeds such as Kiko goats and Katahdin sheep, which are well adapted to the Southeast's environmental conditions.

Findings highlight high adoption of the FAMACHA[®] scoring system, hoof care practices, vaccination programs, and rotational grazing systems. However, the lack of animal weighing poses a risk to achieving sustainable parasite control in the Southeast, and blanket deworming can increase anthelmintic resistance.

Results from this survey demonstrate the need for targeted extension programs focusing on integrated or sustainable parasite control, fecal egg count interpretation, accurate weight-based dosing, record-keeping, grazing management, and overall herd/flock health.

Overall, these findings contribute importantly to the analysis of producer-level data, supporting Extension professionals, veterinarians, researchers, and agricultural organizations in developing stronger, more resilient farmers and sheep- and goat-production systems in the southeastern United States.

Conflicts of Interest

No potential conflict of interest was reported by the author(s).

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