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Research Article

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The Effects of Lacaune×Hungarian Merino Crossbreeding on Fertility, Prolificacy, and Lamb Survival Under Semi-Intensive Conditions

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ABSTRACT

Sheep have been a fundamental part of human civilization since their domestication approximately 10,000 years ago in the Fertile Crescent. Selective breeding has significantly enhanced their productivity, leading to improved milk yield, wool quality, and meat production. Among sheep breeds, Lacaune and Merino are widely recognized for their superior milk and wool traits, respectively. This study evaluates the reproductive performance of Lacaune × Hungarian Merino crossbred ewes under semi-intensive conditions in Aksaray, Türkiye. A total of 72 Hungarian Merino ewes were mated with four Lacaune rams, and their reproductive performance was analyzed. In this study, the conception rate, birth rate, single birth rate, twin birth rate, triplet birth rate, fecundity, and litter size were recorded as 91.47%, 98.48%, 57.57%, 39.39%, 3.04%, 1.33, and 1.45, respectively. Additionally, the weaned lamb rate and lamb survival were calculated as 1.25 and 93%, respectively. The findings of this study align with previous research on Lacaune, Merino, and their crossbreeds, demonstrating that crossbreeding can enhance reproductive traits even in challenging environmental conditions. The results suggest that Lacaune×Hungarian Merino crossbreeding could be an effective approach to sustain high litter size and lamb survival rates in Türkiye. In conclusion, crossbreeding studies need to be expanded to include Türkiye's native sheep breeds with a conscious breeding approach under controlled management conditions to improve and sustain animal production.

1. INTRODUCTION

Sheep are considered one of the earliest domesticated animals in human history and played a crucial role in the Agricultural Revolution. It is believed that they were domesticated around 10,000 years ago in the Fertile Crescent, which includes present-day Türkiye, Iran, and Iraq. The ancestors of modern sheep were wild mouflons, which were widely found in Asia and the Middle East. (Zeder, 2008). Instead of hunting these animals, humans began to breed them in controlled environments to obtain a sustainable source of food, clothing, and other essential resources (Zeder, 2008).

The domestication process provided significant advantages to human communities. Sheep supplied valuable resources such as meat, milk, and wool, supporting the transition to a settled lifestyle (Doyle et al. 2021). In particular, wool production played a crucial role in the development of clothing and the textile industry. Over time, domesticated sheep became more docile, and selective breeding helped enhance desirable traits such as milk quality, wool yield and meat quality (Hopkins et al. 2011; Doyle et al. 2021; Turgut et al. 2023; Koca et al. 2023; Turgut et al; 2024).

Lacune sheep are widely bred in France and are known for their high milk yield. One of their most notable traits is their exceptional performance in milk production. The milk obtained from Lacune sheep is used in the production of high-quality dairy products. Additionally, their resilient structure and adaptability to harsh environmental conditions make them suitable for breeding in various climates (Barillet et al. 2001). Merino sheep, on the other hand, are renowned worldwide for producing the finest-quality wool and meat. Originating from Spain, this breed has become widely established in Australia and other countries over time (Behrem and Gül, 2022; Anaya et al. 2024). Merino wool is highly valued in the textile industry due to its fine fiber structure and superior quality. Moreover, Merino sheep are known for their high adaptability, making them well-suited for breeding in both cold and hot climates (Sawyer et al. 2021). Merino sheep are used to enhance production traits of native Turkish sheep breeds by crossbreeding and their crosses are preferred for higher production traits by farmers in Türkiye (Behrem and Gül, 2022; Atav et al. 2023).

In livestock industry, crossbreeding different breeds to enhance productivity and develop superior genetic traits is a common practice. In this context, the crossbreeding of sheep emerges as a significant option for farmers seeking high animal production. Increasing genetic diversity through crossbreeding may enhances production traits and disease resistance of sheep, making herd management more efficient. The first advantage is increased genetic diversity. Crossbred sheep inherit the strong traits of their parent breeds, making them healthier and more robust (Tesema et al. 2023). For example, crossing a high-milk-yield breed with a native breed can produce sheep that are both productive and resistant to harsh conditions (Černá et al. 2023). Secondly, meat and wool quality can be improved. Through crossbreeding, meat yield can be increased, and finer, higher-quality wool can be obtained (Tesema et al. 2023). This benefits both farmers, by boosting economic returns, and consumers, by providing better products. Finally, crossbred sheep tend to have stronger disease resistance. Crossbreeding helps prevent genetic disorders common in specific breeds

and enhances the immune system of the offspring (Habtegiorgis et al. 2025). These advantages make crossbreeding an essential tool in sustainable sheep farming, ensuring a more profitable and efficient production process.

This study will explore the effects of Lacaune X Hungarian Merino crossbreeding on reproductive traits such as fertility, prolificacy, and lamb survival under semi-extensive conditions.

2. MATERIAL AND METHODS

2.1. Animals

The study was carried out using retrospective data of a farm in Aksaray city, which has harsh climate conditions, Türkiye. In the study, a total of 72 Hungarian Merino ewes and 4 Lacune rams were used as animal material. In the study, Lacune rams were mated with Merino ewes. All animals have undergone nutritional flushing before mating. Synchronization of estrus was not performed. Flock mating was performed and rams were with ewes throughout the season. All ewes were numbered using paint stamp (Fig. 1).

Pregnancy detection was performed by an expert veterinarian. Pregnant ewes were feed by 1.5 kg alfalfa and 0.3 kg barley. Feeding was performed twice daily. In addition, ewes reached the pasture 4 hours daily. Following parturition, lambs were placed separate paddock (5 m2) with their dams. All lambs were reached colostrum in first 24 hours by suckling their dams.

During the first two weeks, ewes and their lambs were feed in the individual paddocks. Following two weeks, creep feeding was performed to the lambs. All lambs were reached the finely chopped alfalfa and concentrate creep feed (Tarım Kredi Yem, Türkiye) ad libitum gradually in addition to suckling. All ewes and lambs reached to the water ad libitum.

2.2. Reproductive traits

In the study, total number of ewes, the number of pregnant ewes, the number of ewes giving birth, the number of lambs born, birth types (single, twin, and triplet), and the number of weaned lambs were recorded to evaluate the effects of LacuneXMerino crossbreeding reproductive performance. When all lambs weaned, reproductive phenotypes were calculated as follow:

Conception rate: the number of pregnant ewes/ total the number of ewes

Birth rate: the number of ewes giving birth/ total the number of ewes

Stillbirth rate: the number of ewes giving birth to stillborn/ total the number of ewes

Infertility rate: the number of infertile ewes/ total the number of ewes

Single birth rate: the number of ewes giving birth single / total number of ewes giving birth

Twin birth rate: the number of ewes giving birth twin / total number of ewes giving birth

Triplet birth rate: the number of ewes giving birth triplets / total number of ewes giving birth

Fecundity: the number of lambs born/ total number of ewes

Litter size: the number of lambs born/ total number of ewes giving birth

Weaned lamb rate: the number of weaned lambs/ total the number of ewes

Livability: the number of lambs born / the number of weaned lambs

3. RESULTS

In the study, 66 ewes were diagnosed as pregnant while six ewes were not pregnant. A total of 65 ewes were given birth healthy while one ewe has given birth stillborn. In the study, 38 of the births were single, 26 were twins, and two were triplets. And, 96 lambs born from 66 ewes during the season. However, six lambs died before weaning. Reproductive performance of ewes was summarized in the Table 1.

Table 1. Reproductive performance of ewes

Traits	n	Rate
Total ewes	72	
Conception rate	66/72	91.67%
Birth rate	65/66	98.48%
Stillbirth rate	1/66	1.52%
Infertility rate	6/72	8.33%
Single birth rate	38/66	57.57%
Twin birth rate	26/66	39.39%
Triplet birth rate	2/66	3.04%
Litter size	96/66	1.45
Fecundity	96/72	1.33
Weaned lamb rate	90/72	1.25
Livability	90/96	93%

4. DISCUSSION

Reproductive traits in ruminants are influenced by various factors, including genetic components (Turgut and Koca, 2024; Turgut et al. 2024; Koca et al., 2024a), management practices (Koca et al., 2024b), and nutrition (Robinson et al., 2006; Bisinotto et al., 2018).

Lacaune sheep are primarily raised under intensive conditions worldwide due to their superior milk yield and quality (Jimenez et al., 2020; Zvonko et al., 2022). In addition to their high milk production, Lacaune sheep are known for their strong reproductive traits, including high conception rates and litter sizes. Under intensive management, Lacaune ewes typically have a litter size ranging from 1.4 to 1.6 (Jimenez et al., 2020). Litter size plays a crucial role in ensuring the sustainability of sheep populations and overall livestock production (Turgut and Koca, 2024). Because of their favorable reproductive and milk production traits, Lacaune sheep are frequently crossbred with other breeds to enhance milk yield in crossbred animals. A study conducted in Spain found that Lacaune × Manchega crosses exhibited similar milk production and reproductive traits as purebred Lacaune sheep (Jimenez et al., 2020). Similar results have been reported in Turcana sheep in Romania. The Turcana breed produces an average of 78 kg of milk per lactation, with a high milk fat and protein content. According to Sauer et al. (2016), Lacaune × Turcana F1 crosses yielded 109 kg of milk per lactation, and their milk quality was comparable to that of both Lacaune and Turcana sheep. These findings suggest that crossbreeding native sheep breeds with Lacaune could be an effective strategy to improve both litter size and milk production. Over the past few decades, Lacaune sheep have been imported from Europe to Türkiye due to their high milk yield and reproductive efficiency. They are now raised under both intensive and semi-intensive systems, with some breeders crossbreeding them with local sheep populations to

improve litter size and milk productivity, which is the focus of this study.

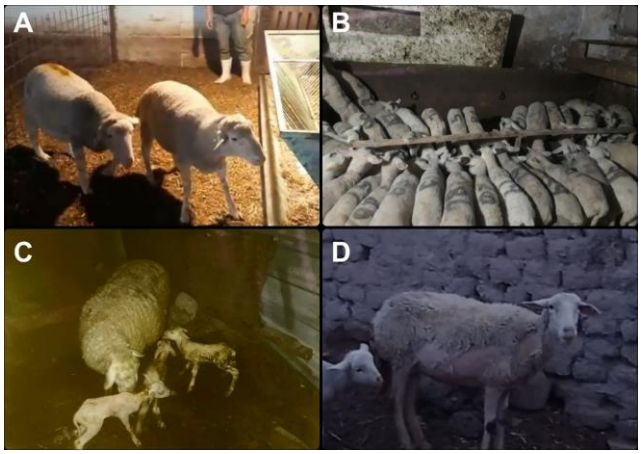

Fig. 1. A: Lacune ram and Hungarian Merino ewe mating, B: Hungarian Merino ewes, C: Newborn lambs, D: Cross-bred Lacaune^{X}Hungarian Merino ewe (F1)

On the other hand, Merino sheep are one of the most significant breeds globally, primarily known for their high-quality wool. However, they are also valued for their meat production and adaptability to various environments. Merino sheep and their crossbreeds are widely preferred in leading sheep-breeding countries, including Türkiye, due to their superior meat production and reproductive traits (Behrem and Gül, 2022; Atav et al., 2023). A study on crossbred Merino sheep (German Black Head Mutton × Karacabey Merino) found a twinning rate of 53% and a triplet birth rate of 6%. Additionally, the lamb survival rate was reported to be 92.5%, and the litter size was 1.66 under semi-intensive conditions (Ceyhan et al., 2009). However, reproductive performance is highly dependent on management practices. Another study found that under traditional extensive conditions in Türkiye, Central Anatolian Merino sheep had a litter size of 1.12 and a twinning rate of 26.7% (Aktaş et al., 2016). Similar results were reported by Aktaş et al. (2015). Furthermore, Behrem et al. (2025) reported a conception rate of 92.3%, a fecundity rate of 1.16, and a litter size of 1.26 for Central Anatolian Merino under extensive conditions.

In this study, the conception rate, single birth rate, twin birth rate, triplet birth rate, fecundity, and litter size were recorded as 91.47%, 57.57%, 39.39%, 3.04%, 1.33, and 1.45, respectively. Additionally, the weaning rate and lamb survival rate were calculated as 1.25 and 93%, respectively. These results align with previous studies on Lacaune, Merino, and their crossbreeds. It is important to emphasize that this crossbreeding study was conducted under semi-intensive conditions with a traditional sheep-breeding approach in harsh environmental conditions in Aksaray province.

5. CONCLUSION

In conclusion, the high conception rate, twinning rate, fecundity, litter size, and lamb survival rate observed in this crossbreeding study in semi-intensive conditions may provide valuable insights for sustaining livestock production in Türkiye's challenging climatic regions. However, these crossbreeding studies need to be expanded to include Türkiye's native sheep breeds with a conscious breeding approach under controlled conditions.

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Conflict of Interest

There is no conflict of interest

Ethical Statement

In this study, ethical approval was not required because retrospective data of Gökduman Sheep Farm between 2021-2022 were used and there was no animal intervention.

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