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RESEARCH ARTICLE

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Economic Sustainability and Future Prospects of Mohair (Angora) Goat Breeding: The Case of Nallıhan District of Ankara Province

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Abstract

This study aims to assess the economic sustainability and prospects of Angora goat breeding in the Nallıhan district of Ankara province. Data from the 2024 production season were collected from 62 farms selected through stratified sampling. On average, Angora goat ownership was equivalent to 5.59 animal units (AU) per farm. The production cost was calculated as 29,229.48 TRY per AU, with 77.60% attributed to variable costs and 22.40% to fixed costs. Feed expenses accounted for the most significant proportion of total costs. Profitability indicators showed an average gross profit of 11,066.36 TRY per AU, absolute profit of 4,519.88 TRY per AU, and a relative profit ratio of 1.15. Survey results revealed low levels of satisfaction among farmers and a low willingness to continue or expand Angora goat farming. To enhance economic sustainability, it is recommended to prioritise the efficient use and development of local feed resources and to rehabilitate grazing lands. Additionally, support policies should be reviewed and restructured to either directly compensate production costs or sufficiently motivate producers to maintain and develop Angora goat production.

Introduction

The Angora goat, also known as the Mohair goat or the Ankara goat, is a small ruminant known for its distinctive mohair coat. The history of this entity dates back to the 13th century, primarily in Ankara and its surrounding areas. After being imported in the 1800s, it lost its status as a Turkish monopoly. The Angora goat caused damage to forests; therefore, its numbers were controlled, and with the widespread use of synthetic fibres in the textile industry, its numbers gradually declined (Şahin, 2013a).

According to 2024 data from the Turkish Statistical Institute, Türkiye had 202,243 heads of mohair goats. According to 2024 data, Ankara province accounted for 70.37% of Türkiye's mohair goat population. The Angora goat population in Türkiye decreased by 12.08% compared to 2004 data, but increased by 1.62 times in Ankara province, reaching 142,325 head. Despite this significant development, the Angora goat population in Nallıhan, a district traditionally prominent in Angora goat breeding, decreased by 58.90% to sixth place in 2024, after ranking second with a 16.73% share according to 2004 data (TURKSTAT, 2025). This situation highlights the varying dynamics at play at the regional level and the need for economic analyses to ensure the sustainability of Angora goat farming.

Numerous studies have been found in the literature on the decline and current status of Angora goat populations, which has been a topic of much older research. Indeed, a study by Örkiz (1985) highlighted the decline in the Angora goat population due to small herd sizes, insufficient breeding bucks, the generally low mohair yield and quality of the bucks currently in use, insufficient pastures, and low global competition. A study by Şahin (2013b) attributed the decline in the Angora goat population in Türkiye to the shrinking mohair market, the availability of cheap synthetic products, shepherd problems, and feed costs. Daşkıran and Koluman (2015) examined current analyses of Angora goat

farms in Ankara province and approaches to sustainable breeding. They stated that if effective and practical measures were not taken, the number of Angora goats would decline. They also stated that the primary reason farmers were moving away from Angora goat farming was economic. Tüfekci (2021) examined the potential of Angora goat breeding in Yozgat province. The study highlighted the decline in the Angora goat population. The reasons for this decline were attributed to flawed legal regulations, the unprofitability of production, and the fact that the market price of mohair is independent of production costs.

On the other hand, economic analyses of purebred and dairy goats were more widespread. Paksoy and Özçelik (2008) conducted an economic analysis of agricultural enterprises raising goats for milk production in Kahramanmaraş province. It was reported that 71.24% of farm income from agricultural activities comes from goat farming. In Kahramanmaraş province, goat farming for milk production is reportedly more economically profitable for larger farms. Kanturk Yigit (2011) used secondary data to determine indicators related to the presence of Angora goats and mohair production in Türkiye. According to the research findings, stated that Ankara goat products such as mohair, meat and milk should be supported, local mohair should be encouraged and research and promotion activities should be carried out on mohair. Yılmaz et al. (2016) examined the effects of goat farming on ecology from the perspective of different institutions. They declared that farmers should be educated on where to graze goats to minimise the ecological impact of goat farming. Gül et al. (2016) calculated the technical efficiency of goat farming in Isparta province in Türkiye in their study. In their study, they calculated the average efficiency scores of farms as 0.44 and 0.66, respectively, assuming constant and varying returns to scale. They identified the most important factors affecting the efficiency of goat production as farmer experience, cooperative membership, milk yield per goat, family, and paid labor. Bakırtaş and Günlü (2018) conducted a technical and socio-economic analysis of 46 goat-raising enterprises in Aksaray province using data from these enterprises. In their study, they determined that 0.99% of the enterprises interviewed produced mohair goats. They noted that labor and feed were the most significant costs in goat farming in Aksaray province, and suggested that input supply, marketing, and health issues in goat farming be addressed to ensure production sustainability. Yilmaz and Gül (2020) calculated the technical efficiency of goat farms in the Western Mediterranean region. In their study, they found a technical efficiency score of 80%. They also identified a positive and significant relationship between meat production and veterinary costs, working capital, family labor, marketing, and concentrate feed per goat. Kadakoğlu et al. (2024) conducted a structural analysis of goat farming in Türkiye. In their study, they stated that approximately 98% of goat breeds raised in Türkiye are hair goats, while 2% are Angora goats. They stated that rising feed prices, insufficient pastures, difficulties finding shepherds, the generally small and scattered nature of farms, and problems encountered during product marketing are all factors affecting the sustainability of goat farming, and that these issues should be addressed.

Studies on the economic structure of mohair goat farming are limited. A study by Örkiz (1983) calculated the cost of mohair production for a flock of 400 head based on 1982 prices. The bare cost of 1 kilogram of mohair to be approximately 634 TRY and stated that producers should be trained on technical issues in order to increase mohair production and reduce mohair costs. Çelik and Bayramoğlu (2010) conducted a cost-benefit analysis of Angora goat farming using data from 46 farms in Konya and Karaman provinces. They calculated that the average herd size in Angora goat farming enterprises was 43.4 head, with a gross profit-to-production ratio of 48.73% and a net profit-to-production ratio of 13.49%. They stated that the most influential factor in the decline in Angora goat numbers was the decline in Angora prices. In a study conducted in the Ankara province by Arzık et al. (2023), data from 812 flocks registered with the Ankara Sheep and Goat Breeders Association were used to evaluate the quantity, price, and quality of Angora goats. They declared that Ankara goat breeding is done in almost all districts of Ankara, that the highest mohair price was in 2019 and that the amount of subsidy given by the state has decreased over the years. No studies were explicitly found for Ankara province or for a region like Nallıhan, where the number of Angora goats has significantly decreased, examining economic sustainability, production costs, profitability indicators, and producers' intentions to continue raising Angora goats.

Therefore, the aim of this study is to reveal the economic sustainability of Ankara goat breeding in the Nallıhan district of Ankara province by focusing on its production costs and profitability, and to test whether the current cost and profitability structure of the breeding is economically sustainable.

Materials and Methods

Material

The main component of this study was the data obtained through a survey method from farmers in the villages of the Nallıhan district of Ankara province, where mohair goat breeding is intensive (Figure 1). Ethical approval for the study was

obtained from Yozgat Bozok University Social and Human Sciences Ethics Committee (Approval No: 20/22). The data were covered from January 2023 to February 2024. In addition to these primary data, secondary data to be used in the research were obtained from the Turkish Statistical Institute (TURKSTAT).

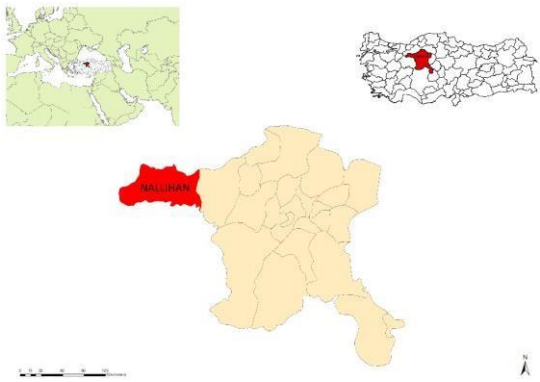

Figure 1. Research area

Methods

Sampling method

Since surveying all farms was not feasible due to time and budget constraints, the "Stratified Sampling Method" was used to determine the sample size of farms. Accordingly, the sample size of farms was calculated as 62 with a 10% margin of error and a 95% confidence limit. The Neyman method was used to stratify the sample farms (Çiçek and Erkan, 1996). Accordingly, farms with 1-5 head of Angora goats were classified as Group I (12 farms), those with 6-15 head of Angora goats as Group II (9 farms), and those with 16 or more head of Angora goats as Group III (41 farms).

Economic Sustainability

This study examined economic sustainability in Angora goat farming from the perspective of production costs, gross production value (GPV), and profitability indicators. Cost elements in Angora goat farming were analysed in two groups: variable and fixed costs, depending on whether they increase or decrease with production volume (Kıral et al., 1999). Depreciation and capital interest costs in Angora goat farming were calculated for tools and machinery, and buildings. Three percent of variable costs was taken into account in calculating general administrative expenses. Comparable labour wages in the region were taken into account in calculating the family labour wage equivalent (Kıral et al., 1999). Depreciation and capital interest costs in Angora goat farming were calculated for tools and machinery, and buildings. Three percent of variable costs was taken into account in calculating general administrative expenses. Comparable labour wages in the region were taken into account in calculating the family labour wage equivalent (Kıral et al., 1999).

To ensure uniformity and comparability, the Angora goat assets of enterprises in different age groups were converted into Animal Unit (AU) using the coefficients specified by Erkuş et al. (1995). In this conversion, does aged over 12 months were assigned a coefficient of 0.10 AU, bucks aged over 12 months 0.12 AU, does aged 6–12 months 0.08 AU, bucks aged 6–12 months 0.08 AU, doe kids aged 0–6 months 0.05 AU, and buck kids aged 0–6 months 0.05 AU. The number of animals in each age–sex category within the enterprises was multiplied by the relevant coefficient, and the results were summed to obtain the total AU for each enterprise. All production cost components, gross production value, and profitability indicators were then standardised by these AU values and expressed on a per-AU basis.

Gross production value was calculated based on the annual income generated by enterprises from Angora goat farming. This covered the entire production year, including mohair and kid production as well as other revenues such as the sale of Angora goats, agricultural support revenues, fertiliser, milk, and dairy products, together with increases in productive asset value. The following formula was used to calculate the productive asset value increase, taking into account animal movements during the year (Kıral et al., 1999).

Productive fixed asset value increase = (End-of-year Angora goat herd value + value of Angora goats sold + value of slaughtered Angora goats) – (Beginning-of-year Angora goat herd value + value of Angora goats purchased)

The following formulas were used to calculate profitability indicators in Angora goat breeding (Açıl and Demirci, 1984; Kıral et al., 1999):

Gross profit = GPV – Variable costs

Absolute profit = GPV – Production costs

Relative profit = GPV / Production costs

Problems encountered by farmers in Angora goat breeding were categorised and presented using open-ended questions. Data related to future trends and increasing Angora goat stock were obtained using categorical and Likert-scale questions.

The tables were generated using statistical software, where the survey data were processed through descriptive analyses. Cross-tabulations, percentages, and ratio calculations were employed to systematically present the findings.

Results and Discussion

Animal Unit (AU) is a standardisation method used to express different animal species as a standard unit of measurement. The Angora goat stock of the interviewed enterprises in the region is presented in AU in Table 1. The enterprises examined had an average of 5.59 AU Angora-goat stock. Total Angora goat stock varied between 0.09 AU and 4.38 AU within the enterprise size groups. 0.45 AU was calculated in Group

I enterprises, 0.71 AU in Group II enterprises, and 8.16 AU in Group III enterprises. The highest share of Angora goat stock in the enterprises was does (aged ≥12 months) with 52.82%. This was followed by buck (aged ≥12 months) with 7.14%, doe (aged 6-12 months) with 18.03%, buck (aged 6-12 months) with 19.56%, doe kid (aged 0-6 months) with 1.04%, and buck kid (aged 0-6 months) with 1.41%. Engindeniz et al. (2017) conducted a study on dairy goats in the provinces of Izmir, Balıkesir, and Çanakkale and found an average of 12.04 AU.

To evaluate the cost structure of Angora goat breeding enterprises, production costs were examined per year (Table 2). Production costs were examined in two groups: variable and fixed costs. Accordingly, variable costs were expenses that varied depending on production volume and farm size. The total variable costs for the average farm were 126,754.08 TRY per year. The highest variable cost item was feed costs, which were 2,262.50 TRY in Group I farms, 5,547.22 TRY in Group II farms, and 84,051.22 TRY in Group III farms. The second largest variable cost element was shepherd wages, which varied between 1,500.00 TRY and 18,402.44 TRY across farm size groups. Other significant variable costs included electricity and heating (12,098.12 TRY on average), veterinary and pharmaceutical expenses (7,859.14 TRY), and other variable expenses (14,762.10 TRY). For small-scale enterprises, variable costs were lower, with an average total variable expense of 8,106.94 TRY in Group

Table 1. Population structure of Angora goats in farms by age and sex categories

Goat age classification	Farm groups			FA*
	I	II	III	
		Au/Farm/Year		
Doe aged ≥12 months	0.10	0.24	4.38	2.95
Buck aged ≥12 months	0.10	0.13	0.54	0.40
Doe aged 6-12 months	0.09	0.15	1.47	1.01
Buck aged 6-12 months	0.17	0.18	1.56	1.09
Doe kid aged 0-6 months	0.00	0.00	0.09	0.06
Buck kid aged 0-6 months	0.00	0.00	0.12	0.08
Total	0.45	0.71	8.16	5.59
		Ratio (%)		
Doe aged ≥12 months	22.06	34.59	53.67	52.82
Buck aged ≥12 months	22.06	18.87	6.67	7.14
Doe aged 6-12 months	19.12	21.38	17.95	18.03
Buck aged 6-12 months	36.76	25.16	19.17	19.56
Doe kid aged 0-6 months	0.00	0.00	1.08	1.04
Buck kid aged 0-6 months	0.00	0.00	1.46	1.41
Total	100.00	100.00	100.00	100.00

Table 2. Production Costs in Angora goat farming in Farms

Cost elements	Farm groups			FA
	I	II	III	
		TRY/Farm/Year		
Feed	2,262.50	5,547.22	84,051.22	56,825.40
Shepherd	1,500.00	2,000.01	18,402.44	12,750.00
Electricity-heating	777.78	1,250.02	17,792.68	12,098.12
Veterinary-medicine	972.22	1,400.02	11,292.68	7,859.14
Other foreign labor wages	408.33	1,013.89	8,972.56	6,159.68
Revolving fund interest	386.04	669.17	8,867.59	6,035.91
Salt-licking stone	600.06	788.89	7878.05	5,440.33
Vitamins	241.67	550.08	7102.44	4,823.40
Other variable costs	958.33	833.33	21,859.76	14,762.10
A. Total variable costs	8,106.94	14,052.63	186,219.42	126,754.08
Family labor wages	3,989.06	3,769.93	34,540.24	241,60.45
Fixed capital interest	300.31	631.14	7,640.93	5,202.61
General administrative expenses	243.21	421.58	5,586.58	3,802.62
Depreciation	178.88	312.81	5,045.29	3,416.43
B. Total fixed costs	4,711.46	5,135.46	52,813.04	36,582.12
Total production costs (A+B)	12,818.40	19,188.09	239,032.46	163,336.21

I enterprises, while this value reached 186,219.42 TRY in Group III.

Fixed costs are expenses that remain constant regardless of production volume. The largest fixed cost item was family labour compensation, and the proportion of this cost relative to other fixed costs was highest in Group III enterprises, with an average of 34,540.24 TRY. This was followed by fixed capital interest at 7,640.93 TRY, general administrative expenses at 5,586.58 TRY, and depreciation at 5,045.29 TRY. When production costs were examined, those in Group I and Group II farms were the highest among the groups, at an average of 239,032.46 TRY. Average production costs in Group I and Group II farms were 12,818.40 TRY and 19,188.09 TRY, respectively. Variable costs such as feed and labour accounted for the largest share of production costs in Angora goat breeding. Group III farms, in particular, had the highest costs in both variable and fixed costs. Despite this, it was determined that farm owners achieved a larger production structure by taking advantage of economies of scale. Small-scale farms, on the other hand, operated at lower costs and, consequently, had limited production capacity.

The production costs for Angora goat breeding incurred by enterprises operating in the region under consideration were examined based on the AU value per year (Table 3). The average production cost of the enterprises was determined to be 29,229.48 TRY/AU per year, with Group III enterprises having the highest production cost at 29,284.44 TRY. Group I followed this group of enterprises at 28,275.89 TRY/AU and Group II enterprises at 27,152.96 TRY/AU. Variable costs, which play a significant role in the production process, were calculated as 22,683.00 TRY/AU on average. These costs varied between 17,882.96 TRY/AU and 22,814.19 TRY/AU across enterprise groups. Feed costs, which accounted for the largest share of variable costs, were a significant portion of production costs at 10,169.07 TRY/AU. Feed costs were followed by shepherd fees at 2,281.65 TRY/AU, and electricity and heating costs at 2,164.99 TRY/AU. Additionally, other variable costs in the production process included veterinary medicine, other foreign labour fees, revolving fund interest, salt, vitamins, licking stones, and other costs.

Fixed costs are long-term costs that ensure the sustainability of enterprises and are incurred in all situations, regardless of production. As a result of the calculations, the average fixed cost was determined to be 6,546.47 TRY/AU per year. Fixed costs varied according to enterprise size; this value was calculated as an average of 10,392.93 TRY/AU in Group I enterprises, 7,267.16 TRY/AU in Group II enterprises, and 6,470.25 TRY/AU in Group III enterprises. The highest valued expense element among fixed costs was the family labour wage (4,323.58 TRY/AU). This was followed by fixed capital interest (931.02 TRY/AU), general administrative expenses (680.49 TRY/AU), and depreciation (611.38 TRY/AU). In general, it was observed that cost differences among farm size groups were due to differences in production methods and farm structures. This led to cost differences based on the farms' production

Table 3. Production costs by cattle unit in Angora goat farming activities in businesses

Cost elements	Farm groups			FA
	I	II	III	
		TRY/AU/Year		
Feed	4,990.81	7,849.84	10,297.32	10,169.07
Shepherd	3,308.83	2,830.20	2,254.53	2,281.65
Electricity-heating	1,715.69	1,768.90	2,179.82	2,164.99
Veterinary-medicine	2,144.61	1,981.16	1,383.49	1,406.42
Other foreign labor wages	900.74	1,434.75	1,099.25	1,102.29
Revolving fund interest	851.57	946.94	1,086.39	1,080.14
Salt-licking stone	1,323.67	1,116.35	965.16	973.56
Vitamins	533.09	778.42	870.14	863.16
Other variable costs	2,113.97	1,179.25	2,678.09	2,641.72
A. Total variable costs	17,882.96	19,885.80	22,814.19	22,683.00
Family labor wages	8,799.40	5,334.81	4,231.61	4,323.58
Fixed capital interest	662.45	893.13	936.11	931.02
General administrative expenses	536.49	596.57	684.43	680.49
Depreciation	394.59	442.66	618.11	611.38
B. Total fixed costs	10,392.93	7,267.16	6,470.25	6,546.47
Total production costs (A+B)	28,275.89	27,152.96	29,284.44	29,229.48

Table 4. Proportional distribution of cost elements in Angora goat farming activities in farms

Cost elements	Farm groups			FA
	I	II	III	
	Ratio (%)			
Feed	17.65	28.91	35.16	34.79
Shepherd	11.70	10.42	7.70	7.81
Electricity-heating	6.07	6.51	7.44	7.41
Veterinary-medicine	7.58	7.30	4.72	4.81
Other foreign labor wages	3.19	5.28	3.75	3.77
Revolving fund interest	3.01	3.49	3.71	3.70
Salt-licking stone	4.68	4.11	3.30	3.33
Vitamins	1.89	2.87	2.97	2.95
Other variable costs	7.48	4.34	9.15	9.04
A. Total variable costs	**63.24**	**73.24**	**77.91**	**77.60**
Family labor wages	31.12	19.65	14.45	14.79
Fixed capital interest	2.34	3.29	3.20	3.19
General administrative expenses	1.90	2.20	2.34	2.33
Depreciation	1.40	1.63	2.11	2.09
B. Total fixed costs	**36.76**	**26.76**	**22.09**	**22.40**
Total production costs (A+B)	**100.00**	**100.00**	**100.00**	**100.00**

strategies, inputs used, and farm management structures.

Table 4 examines the proportional distribution of cost elements within production costs in Angora goat breeding operations. It was determined that 77.60% of production expenses consisted of variable costs and 22.40% consisted of fixed costs.

Among variable costs, feed costs, and among fixed costs, family labour compensation stood out more prominently than other expenses. On average, feed costs accounted for 34.79%, while family labour compensation accounted for 14.79%.

Feed costs, concerning farm size, were calculated as 17.65% in Group I farms, 28.91% in Group II farms, and 35.16% in Group III farms. Family labour compensation also ranged between 14.45% and 31.12% across farm groups. Specifically, as the farm size increased, the family labour compensation (a fixed cost item) decreased. Similarly, veterinary and pharmaceutical expenses also decreased as the farm size increased. This figure was found to be 7.58% in Group I farms, 7.30% in Group II farms, and 4.72% in Group III farms.

General administrative expenses are 1.90% in Group I farms, rising to 2.34% in Group III farms. Depreciation costs range from 1.40% to 2.11%. Accordingly, it was observed that the depreciation burden may be slightly higher in large-scale farms, depending on the presence of machinery and equipment.

The findings indicated that as the size of the farm increases, the share of variable costs increases, while the share of fixed costs decreases. This demonstrates the cost advantages provided by economies of scale. Feed costs, in particular, become the most significant cost element as the farm size grows, and their share of total production costs rises. The use of family labour is commonly observed in small-scale farms. However, while large farms enjoy cost advantages in veterinary medicine and labour expenses, feed costs remain the most significant expense item regardless of farm size. In a study conducted by Çelik and Bayramoğlu (2010) on Angora goats, the share of variable costs in production costs was calculated as 59.26% and the share of fixed costs was calculated as 40.74%. It was stated that the highest cost element was feed costs, accounting for 33.11%. Engindeniz et al. (2017) stated that the highest cost elements among variable costs were temporary labour wages and feed costs. In a study conducted on dairy goats in Çanakkale province, the share of variable costs in production costs was 52.30% and the share of fixed costs was 47.70%. The highest cost elements were feed costs with a share of 43.88% and family labour wages with a share of 25.39% (Aktürk and Arsoy, 2020). In the study conducted in Aksaray province, the share of variable costs in production costs was calculated as 79.9% and the share of fixed costs as 20.03%. The most significant cost elements were found to be feed (34.37%) and family labour (31.15%) (Bakırtaş and Günlü, 2018). The study findings were similar to those obtained from the literature.

In the study, mohair yield was calculated based on farm size and the number of cattle. The data obtained

were for dirty mohair (Figure 2). Mohair yield was 0.78 kg/head in Group I farms, 0.86 kg/head in Group II farms, and 1.19 kg/head in Group III farms. The average mohair yield for the farm was calculated as 1.07 kg/au. In a study conducted in Ankara province by Arzık et al. (2023), average dirty mohair yields for kids and dams were reported to be 1.42 kg and 3.62 kg, respectively. Accordingly, It could be argued that farm size had a direct impact on mohair yield. Mohair yield per animal was higher in large-scale farms. This indicated that better feeding, care, and breeding methods were implemented in large-scale Angora goat breeding operations. It was hypothesised that the lower yields in small-scale farms could be due to limited resources for feeding and care practices in the breeding area.

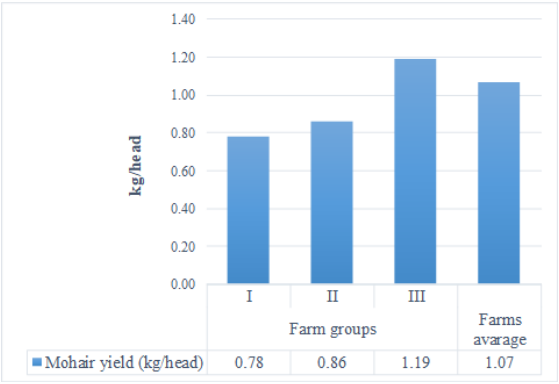

Figure 2. Mohair yield in enterprises

Gross production value is an economic indicator that represents the total market value of goods and services produced by agricultural enterprises in a given period (Kıral et al., 1999). The average gross production value for each enterprise was calculated as 188,593.61 TRY. This value reached 19,846.19 TRY in Group I enterprises, 30,798.22 TRY in Group II enterprises, and 272,621.11 TRY in Group III enterprises (Table 5).

When the income elements constituting GPV of the enterprises were examined, it was found that the most significant share belonged to the animal sales. 74.29% of GPV was derived from animal sales, demonstrating that animal husbandry was the primary source of income for these enterprises. Mohair income ranked second, accounting for 14.01% of GPV. Other income sources, such as agricultural subsidies (4.78%), fertiliser (2.78%), increase in value of productive fixed assets (2.75%), and milk and dairy product revenues (1.39%), have lower rates. Similarly, a study by Şahinli et al. (2020) found that the share of revenue from mohair was 13.73%. The findings indicated that mohair production was not the primary objective of the enterprises in Angora goat breeding. There was no difference between Angora goat breeding and other goat breeding activities, other than the type of income generated. This was detrimental to the sustainability of Angora goat breeding. (Table 5).

Income distribution varied across size groups. While small and medium-sized enterprises did not record any revenue from milk and dairy product sales, large-scale enterprises generated an average of 3,951.22 TRY from this revenue item. This demonstrates that large enterprises can also

Table 5. Gross production value in Angora goat breeding in farms

Income elements	Farm groups			FA
	I	II	III	
	TRY/Farm/Year			
Livestock sales	12,300.00	22,624.44	203,313.41	140,114.03
Mohair	3,083.33	3,388.89	38,304.88	26,419.35
Agricultural subsidies	886.67	1,057.78	13,146.34	9,018.71
Fertilizer	2,100.04	2,027.78	6,873.17	5,245.98
Productive fixed asset value increase	1,476.15	1,699.33	7,032.08	5,182.63
Milk and dairy products	0.00	0.00	3,951.22	2,612.90
Total	**19,846.19**	**30,798.22**	**272,621.11**	**188,593.61**
	Ratio (%)			
Livestock sales	61.98	73.46	74.58	74.29
Mohair	15.54	11.00	14.05	14.01
Agricultural subsidies	4.47	3.43	4.82	4.78
Fertilizer	10.58	6.58	2.52	2.78
Productive fixed asset value increase	7.44	5.52	2.58	2.75
Milk and dairy products	0.00	0.00	1.45	1.39
Total	**100.00**	**100.00**	**100.00**	**100.00**

transform by-products into economic value.

The average income generated by enterprises from agricultural subsidies was calculated as 9,018.71 TRY. This value varied between 886.67 TRY and 13,146.34 TRY, depending on the size of the enterprise. These findings revealed the impact of farm size on GPV components and differences in income structure. Larger-scale farms had a broader income spectrum, generating income from sources other than animal sales. This was considered significant because it demonstrated an increase in diversity and value-added production.

Gross profit of enterprises in the research region was calculated by subtracting the total variable costs from the gross production value obtained from the Angora goat breeding activity (Table 6). Accordingly, the enterprises achieved an average gross profit of 61,839.52 TRY. Gross profit varied between 11,739.25 TRY and 86,401.69 TRY depending on the enterprise size.

Absolute profit was determined to be 25,257.40 TRY on average. Relative profit was calculated by dividing the gross production value by total production costs. Accordingly, relative profit was determined to be 1.55 in Group I enterprises, 1.61 in Group II enterprises, and 1.14 in Group III enterprises. The average relative profit was 1.15. Accordingly, for every 100 TRY spent on Angora goat breeding, the enterprises generated 115 TRY in revenue. The higher relative profits of small farms were linked to the higher operational costs faced by larger farms. Accordingly, although large enterprises achieve higher production volumes, their relative profits fall due to increased costs. Similarly, in a study conducted by Çelik and Bayramoğlu (2010), the relative profit was calculated as 1.15.

The profitability indicators of enterprises engaged in Angora goat breeding are examined in Table 7, based on cattle unit value. The average enterprise gross production value was calculated as 33,749.36 TRY/AU, absolute profit as 4,519.88 TRY/AU, and gross profit as 11,066.36 TRY/AU.

Among enterprise size groups, the GPV ranged from 33,399.47 TRY/AU to 43,778.36 TRY/AU. The highest GPV was in Group I enterprises (43,778.36 TRY/AU). This indicated that Group I enterprises achieved more efficient production and generated higher income.

The average enterprise absolute profit was calculated as 4,519.88 TRY/AU. The absolute profit in Group I enterprises was 15,502.48 TRY/AU, in Group II enterprises it was 16,429.43 TRY/AU, and in Group III enterprises it was 4,115.03 TRY/AU. This showed that group I and II enterprises achieved higher absolute profits, while group III enterprises achieved lower profits. This difference indicated that larger enterprises faced higher costs, thus decreasing profit margins.

Gross profit was determined as 25,895.40 TRY/AU in group I enterprises, 23,696.59 TRY/AU in group II enterprises, and 10,585.28 TRY/AU in group III enterprises. This indicator was 11,066.36 TRY/AU on average for the enterprise.

Table 8 focuses on the satisfaction levels of

Table 6. Profitability indicators in Angora goat farming activities in enterprises

Indicator	Unıt	Farm groups			FA
		I	II	III	
Absolute profit	TRY/Farm/Year	7,027.79	11,610.13	33,588.64	25,257.40
Gross profit	TRY/Farm/Year	11,739.25	16,745.59	86,401.69	61,839.52
Relative profit	Ratio	1.55	1.61	1.14	1.15

Table 7. Profitability indicators by cattle unit in Angora goat farming operations in enterprises

Indicators	Farm groups			FA
	I	II	III	
	TRY/AU/Year			
GPV	43,778.36	43,582.39	33,399.47	33,749.36
Absolute profit	15,502.48	16,429.43	4,115.03	4,519.88
Gross profit	25,895.40	23,696.59	10,585.28	11,066.36

Table 8. Levels of satisfaction of processors with angora goat farming

Farm groups	Low	Medium	High	Very high	Total
	Ratio (%)				
I	33.33	50.00	16.67	0.00	100.00
II	22.22	66.67	11.11	0.00	100.00
III	26.83	56.10	12.20	4.88	100.00
FA	27.42	56.45	12.90	3.23	100.00

enterprises with Angora goat breeding. Accordingly, an average of 56.45% of enterprises were moderately satisfied with Angora goat breeding. An average of 50.00% of enterprises in Group I, 66.67% of enterprises in Group II, and 56.10% of enterprises in Group III were moderately satisfied.

The percentages of enterprises with low satisfaction varied between 22.22% and 33.33% across enterprise groups. Satisfaction rates categorised as high and very high were found to be quite low across all groups. High satisfaction rates were 16.67% and 11.11% in Groups I and II, respectively, while this rate was 12.20% in Group III. Only Group III enterprises had a very high satisfaction (4.88% of enterprises).

The tendency of the farmers in the research region to continue their mohair goat breeding activities was also examined (Table 9). The percentage of those who definitely considered continuing mohair goat breeding was determined to be 3.23%. 40.32% of the interviewed farmers did not intend to continue mohair goat breeding. However, 32.26% of the farmers were undecided, and 8.06% definitely did not intend to continue.

In Group I enterprises, it was noteworthy that a large percentage of the owners (83.33%) did not intend to continue mohair goat breeding. In Group II enterprises, 55.56% of the farmers did not intend to continue mohair goat breeding. In Group III enterprises, the total percentage of those who did not intend to continue mohair goat breeding (24.39%) and those who definitely did not intend to continue mohair goat breeding (12.20%) was 36.59%. Overall, the findings revealed that producers generally had a negative approach to continuing their Angora goat breeding activities, but the rate of indecision was also high (32.26%).

Interviewed farmers were asked about their intention to continue raising Angora goats in the future, as well as their thoughts on increasing their numbers (Table 10). Group I farms did not express a positive opinion on increasing the number of Angora goats. Therefore, all of the I farmers declared that they would not increase their herd numbers. An average of 11.11% of Group II farms considered increasing their number of Angora goats, whereas 88.89% indicated that they did not plan to do so. In Group III farms, 26.83% stated that they intended to increase their number of Angora goats.

An average of 19.35% of the farmers did not intend to increase their number of Angora goats, while 80.65% did not plan to change this intention. Accordingly, the vast majority of farmers had a negative attitude toward increasing the number of Angora goats.

Table 11 examines the problems faced by the interviewed enterprises in their Angora goat breeding activities. 58.06% of the producers reported high feed costs; 35.48% cited inadequate subsidies; 25.81% cited inadequate pasture land; 16.13% cited high input costs; 11.29% cited animal diseases; 6.45% cited a wild wolf problem; and 1.61% cited difficulties in recruiting shepherds. Similarly, a study conducted by Doğan and Algül Karadaş (2024) on Angora goats in Ankara province identified insufficient Angora prices, low productivity, pasture problems, shepherd problems, and animal losses due to diseases as the main problems.

Table 9. Farmers' thoughts on continuing Angora goat farming activities

Farm groups	Definitely not considering	Not considering	Undecided	Considering	Definitely considering	Total
			Ratio (%)			
I	0.00	83.33	16.67	0.00	0.00	100.00
II	0.00	55.56	44.44	0.00	0.00	100.00
III	12.20	24.39	34.15	24.39	4.88	100.00
FA	8.06	40.32	32.26	16.13	3.23	100.00

Table 10. Opinions of farmers on increasing their number of angora goats

Farm groups	Yes	No	Total
		Ratio (%)	
I	0.00	100.00	100.00
II	11.11	88.89	100.00
III	26.83	73.17	100.00
FA	19.35	80.65	100.00

Table 11. Problems encountered in Angora goat breeding activities in enterprises

Problems	Farm groups			FA*
	I	II	III	
	Ratio (%)			
High feed costs	100.00	58.33	46.34	58.06
Inadequate support	44.44	25.00	36.59	35.48
Insufficient pasture land	66.67	33.33	14.63	25.81
High input costs	0.00	0.00	24.39	16.13
Animal diseases	0.00	8.33	14.63	11.29
Wild wolf damage	0.00	0.00	9.76	6.45
Difficulty in recruiting shepherds	0.00	8.33	0.00	1.61

*Exceeds 100.00% due to multiple responses.

Conclusion

The findings indicated that the economic sustainability of Angora goat breeding is quite low, and it also poses a serious risk to the future of Angora goat breeding. Low profitability, the reluctance of a significant portion of producers to continue this activity, and the lack of plans to increase goat numbers necessitated urgent and targeted interventions.

In this context, priority should be given to the efficient use and development of local forage resources and the improvement of pasture lands to reduce feed costs. In addition, encouraging the cultivation of forage crops and supporting region-specific roughage production projects would make a significant contribution to reducing producers' input costs. Support policies should be reviewed and increased to a level that motivates producers, or they should be restructured to offset production costs directly.

Furthermore, increasing producer incomes through value-added product development and diversifying marketing channels were critical to boosting the motivation of undecided and prospective Angora goat breeders. In particular, the promotion of mohair, branding initiatives, and the development of export opportunities stand out as strategic steps to strengthen this process.

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Conflict of Interest

The author(s) declare that they have no competing interests.

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