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Some General Comments on The Results For Sheep Breeding Researches at Atatürk University Farm

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- Crossbreeding
- Morkaraman
- Merino

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- Live body weight
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- Fleece traits

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ABSTRACT:

This article puts forward to brief comparative results of three unpressed doctorate thesis relating to the investigation on Merino, Morkaraman and their crosses which were maintained in Ataturk University farm, Erzurum. It contains; (i) General aspects of sheep population in Türkiye for both pure and crossbred genotypes relating to domestic and improved sheep breeds were summarized, (ii) The aims of research projects which were undertaken in Ataturk University farm were outlined, (iii) The effects of environmental factors such as year, age of ewe, breeding systems, birth status and sex relating productive and reproductive traits depended on data collected from Merino, Morkaraman and their crossbred sheep flocks were analyzed, (iv) Genetic parameters as heritability, repeatability and correlation estimates for the characteristics studied have been calculated from data adjusted for the effects of statistically significant environmental factors, (v) It was concluded that it can be possible to developed a more productive type of sheep for the establishment of a new Morkaraman flock in the area, by mating inter se of the members of a combination of the genotypic groups and applying a selection program for the criterions aimed.

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INTRODUCTION

There are 44.7 million breeds of sheep in Türkiye according to novel data (TUIK, 2022). A great majority of the sheep population consist of native breeds, but only a small percentage of the sheep is Merino and crosses. The approximate ratio of the native breeds within the total population and their geographic distribution to the Anatolian regions are as follow: 44% Akkaraman (Middle Anatolia), 22% Morkaraman (East Anatolia), 12% Dağlıç (West and Middle Anatolia), 4% İvesi (South Anatolia), 6% Kıvırcık (Agean and Marmara region), 3% Karayaka (Black-sea region), 3% Turkish Merino (Marmara and Middle Anatolia), and 6% Sakız, Herik, Tuj and Hemşin (different regions of Anatolia).

The yield gained per animal is not at a reasonable level, even though Türkiye has a significant number of sheep compared to other countries in the World. The sheep breeds do not perform well due to poor environmental conditions and insufficient genetic quality. However, native sheep breeds still meat the domestic demand for mutton, milk, and carpet fibres. The manufacturing industry relies on imported fine wool to meet its needs. Merinos and their crosses produce only a small amount of high quality wool. While sheep have been bred in Anatolia for perhaps hundreds of years, scientific breeding practices began in the early 20th century.

The goal of sheep breeding was to enhance the quantity and quality of wool, meat, milk and reproductive performance per animal (Filya et al., 1995; Sönmez et al., 2009).

Morkaraman is dominant sheep breed of eastern Anatolia. The sheep population have reached their weak present performance by long-term ordinary selection. This breed has a long fat tail (6-8 kg). Milking of ewes is a common practice on all kinds of privately owned family farms and the sheep are also valuable as a source of meat. Sheep producers can earn a considerable amount of income by selling weaners or 6-8 months of old lambs. An investigation (Karataş, 1973) indicated that the contribution of production characteristics to the total income in Merino and Morkaraman breeds were 21% and 7% (greasy fleece weight), 14% and 22 (milk yield), 65% and 71% (lambs sold as weaners), respectively.

In sheep breeding, selection takes longer to obtain results due to the high number of characteristics (Taşkın et al., 1999), and the low-medium degree of heritability of characteristics (Taşkın et al., 2012). Since selection is limited in terms of genetic progress (Kaymakçı and Taşkın, 2008), crossbreeding studies have gained importance (Altın et al., 2005). As selection is limited in terms of genetic progress, crossbreeding studies have become increasingly important. However, if the gain is increased, it is claimed that the crossbreeding of domestic breeds with Merino breeds may provide a better superiority compared to other crossbreeds (Üçtepe, 2016).

Several research projects have been carried out to improve the productive characteristics of the Morkaraman and Merino sheep breeds and their crosses in the University farm (Köprücü, 1974; Özsoy 1974; Vanlı, 1974). It would be desirable to produce new hybrid types of sheep to satisfy the demand for animal products particularly in Eastern Türkiye. Alternative dual-purpose types of sheep could be built up with respect to the characteristics outlined below: (i) milk for cheese production, (ii) wool for the textile industry, (iii) wool for carpet manufacturing, (iv) high reproducion rate for meat production.

In the past, some researches relating three doctorate thesis have been done on the inheritance of some economically important production characteristics in both Merino and Morkaraman breeds (Özsoy and Vanlı, 1985). The effects of environmental factors on production traits have been analysed and their genetic parameters have been estimated. The predicted parameters of the traits have been taken as a guide for constructing a proper breeding plan for the flock. The comparative results obtained from the three researches will be presented here briefly.

MATERIALS AND METHODS

Atatürk University Farm

The University farm is located in Erzurum on a highland plateu, situated at an elevation of 1,867 meters above sea level in eastern Türkiye (39°54'47"N-41°13'20"E). A very harsh climatic condition with an extremly cold and snowy winter have been practiced in this region. Dryland forming is applied typically for production of grain and livestock. The area has extensive pastures of good quality which are cut for hay production. The pasture production is at its best quality during spring and aerly summer. The feeding and management conditions of the herds are given by Vanlı (1974).

All animals are pedigreed and random mating is practiced within the flocks. No selection has been applied either for purebred or crossbred animals. Each of the flocks is a closed to outside introductions, maintaining a self-contained breeding population.

An open-shed system is used for the accommodation of animals. Feeding primarily relies on natural pasture resources. During the summer, sheep graze on pasture, in winter they are occasionally fed hay with mixed some grain for supplemental nutrition. Ewes are reguarly milked for cheese processing.

Data were collected from productive and reproductive traits of Merinos, Morkaraman and their crossbred ewes.

Statistical analysis

The effects of some environmental factors on productive traits have been analysed for Merino and Morkaraman and crossbred mature ewes using linear mathematical models by the method of least-squares given by Harvey (1977). Models assumed for statistical analysis were,

$$Y_{ijk} = \mu + a_i + b_j + (ab)_{ij} + e_{ijk}$$

for fleece and milk charateristics, and

$$Y_{ijklmn} = \mu + a_i + b_j + c_k + d_l + f_m + e_{ijklmn}$$

for reproductive traits. Where, Y_{ijk}, or Y_{ijklmn} = yield traits observations, μ = the population mean, a_i = the effect of year, b_j = the effect of age of ewes, c_k = effect of breeding system, d_l = the effect of birth status, f_m = the effect of sex of lamb, e_{ijklmn} = normal, independent, random error. Harvey's pocked computer program (Harvey, 1977) was used for statistical analysis. Also, Duncan's multiple range test (Duncan, 1955) was used for the difference classes.

RESULTS AND DISCUSSION

Merino and Morkaraman Purebreeds

The least-square means of the charateristics of Merino, Morkaraman and their crosses are shown in Table 1 (Köprücü, 1974; Özsoy, 1974; Vanlı, 1974). It is clear that the yields of Merino ewes are not as compared with the other Merinos throughout the world. Merino has strong but limited wool yield, and its reproductive ability is not sufficent. Nevertheless, they exhibited a reasonable body size under farm conditions. The possible reasons why Turkish Merinos perform less well than other Merino breeds could be due to following factors: (i) keeping animals under highland conditions, (ii) no selection practices for the characteristics, (iii) milking of the ewes on the farms.

The means of Morkaraman traits indicate that Morkaraman is a typical indiginous sheep breeds. All its production characteristics, except body weight at shearing, are low in values. It should be pointed out that the long tail makes a significant contribution to body weight.

Table 1. Least-Squares means for some production characteristics of pure Merino and Morkaraman ewes

Characteristics	Merinos	Morkaraman
Greasy fleece weight (g)	2912±36	1428±22
Clean fleece weight (g)	1729±27	984±16
Fibre diameter (Micron)	23.2±0.2	---
Staple length (mm)	51.5±0.9	117±1.3
Body weight at shearing (kg)	56.7±0.4	53.6±3.1
Lactation milk yield (ml)	-	79354±1698
Maximum milk yield (ml)	-	1072±18
Average milk yield (ml)	-	560±9
Butter fat yield (g)	-	4067±112
Lactation period (day)	-	140±1.4
E_{CEJ} (%)	90.0±1.1	83.9±1.2
L_{BEL} (%)	125.3±1.1	113.2±1.3
L_{WLB} (%)	84.8±0.8	94.1±1.0
L_{WEJ} (%)	96.6±1.7	91.2±1.9

E_{CEJ} (%) = Percentage of ewes conceived per ewe joined, L_{BEL} (%) = Percentage of lambs born per ewe lambing, L_{WLB} (%) = Percentage of lambs weaned per lamb born., L_{WEJ} (%) = Percentage of lambs weaned per ewe joined.

It is also important to note that number of lambs weaned per lamb born of Morkaraman flock is slightly beter than the same ratio in Merino flock, and Morkaraman lambs have a better survival rate. The adaptation of Merino ewes to eastern Anatolian condition with respect to reproductive performance is sufficient enough. However, it is not considered that Merino ewes have much more superiority for reproduction traits to Morkaraman ewes.

The analysis of variance and the variance component estimates of the mean squares for the traits of Morkaraman and Merinos ewes were summarized in Tables 2-3.

Table 2. Source of variation and estimates of variance components for some reproductive characteristics of Merino and Morkaraman ewes (%)

Source of variation	E_{CPJ}	L_{BEL}	L_{WLB}	L_{WEJ}
Year	1.09**	1.77**	3.63**	4.60**
Age	0.00	9.12**	0.64**	4.64**
Breeding system	1.27**	2.97	3.81**	0.15**
Birth status			0.81**	
Sex			0.75**	
All factors	2.36	13.86	9.64	9.39
Error	97.64	96.14	90.36	90.61

*P<0.05, **P<0.01

Table 3. Source of variation and estimates of variance components for some production characteristics of Merino and Morkaraman ewes

Source of variation	Year		Age		Year*Age		All factors		Errors	
Breeding systems	MM	KK	MM	KK	MM	KK	MM	KK	MM	KK
Greasy fleece weight	0.12**		0.16**				0.28		0.72	
Clean fleece weight	0.36**		0.21**		0.02*		0.59		0.41	
Fibre diameter	0.26		0.17**		0.01		0.44		0.56	
Staple length	0.29**	0.07**	0.17**	0.02*	0.01		0.47	0.09	0.53	0.91
Body weight			0.29**	0.09	0.01	0.08**	0.30	0.17	0.70	0.83
Milk yield		0.09*		0.05		0.03*		0.17		0.83
Maximum milk yield		-		0.10		0.04**		0.14		0.86
Average milk yield		0.14*		0.06		0.04**		0.24		0.76
Butter fat yield		0.10**		0.04**		0.02		0.16		0.84
Lactation period		0.45**						0.45		0.55

*P<0.05, **P<0.01, MM = Merino, KK = Morkaraman

These results showed that the effect due to the non-measurable factors have contributed significantly higher to phenotypic variation for the traits studied in both Merinos and Morkaraman flocks. Greasy and clean fleece weights of Morkaraman ewes were not influenced by these environmental factors. For Morkaraman flock, the variation due to the year x age interaction in the total variation of the traits seemed small, although its effect was statistically significant. On the other hand, the value of level of sensivity to the environment of production characteristics were higher in Merino flock. In general, these environmental factors have caused less variation in Morkaraman ewes than in the Merino flocks. This is quite reasonable, because of the production level of Morkaraman ewes and their ability to adapt to particular environment. Furthermore, it is well known that highly productive animals are more sensitive to the environmental changes than the less nonsensitive ones.

Merino x Morkaraman crossbreds

The analysis of variance and the variance component estimates of the mean squares for productive and reproductive traits of Merino, Morkaraman and their crosses were summarized in Tables 4, 5, 6, 7.

Table 4. Reproductive traits of ewes

	Per ewe mated				Per ewe lambing		
Genotype	**N**	**Ewes lambing**	**Lambs born**	**Number of lambs weaned**	**N**	**Lambs born**	**Number of lambs weaned**
Morkaraman(K)	1252	0.83±0.01^{c}	0.92±0.02^{c}	0.86±0.02	1055	1.11±0.02^{d}	1.03±0.02^{c}
Merino (M)	952	0.87±0.01^{abc}	1.14±0.02^{a}	0.96±0.02	816	1.31±0.02^{a}	1.10±0.02^{abc}
KM/MK	582	0.91±*0.02^{ab}	1.10±0.03^{ab}	1.02±0.03	528	1.22±0.02^{bc}	1.13±0.02^{ab}

a, b, c,d : Means with different superscript are statistically significant.

Table 5. Flecee and body weight at shearing

Genotype	N	Greasy fleece weight	Body weight
Morkaraman(K)	1043	1.85±0.02a	60.50±0.22a
Merinos (M)	767	3.02±0.03b	60.0±0.25a
KM/MK	520	2.90±0.03c	65.7±0.30b

a, b, c : Means with different superscript are statistically significant.

Table 6. Milk traits

Genotype	N	Lactation length	Lactation milk yield
Morkaraman(K)	125	141±2.6a	81.4±2.9a
Merino (M)	50	109±3.9b	65.5±4.3b
KM/MK	82	135±2.9a	74.7±3.2ab

a, b : Means with different superscript are statistically significant.

Table 7. Weight of lambs taken at different times

Genotype	N	Weaning weight	N	Weight at shearing
Morkaraman(K)	632	20.5±0.17	260	50.5±0.45
Merino (M)	700	18.4±0.17	218	47.0±0.46
KM	162	20.6±0.31	62	55.0±0.70
MK	137	22.6±0.36	63	54.9±0.73

The production levels of traits yielded by the crosses between Merino and Morkaraman pure breeds of ewes, except milk production, were higher than pure Morkaraman sheep (Özsoy and Vanlı, 1985). Trait such as number of ewes lambing, number of lambs born and number of lambs weaned per ewe mated for ♂ Morkaraman*Merinos ♀ (KM) and ♂ Merinos*Morkaraman ♀ (MK) crosses had 0.08, 0.18 and 0.16 more values than the figures given for purebred Morkaraman ewes, respectively. At the same time, KM/MK crosses showed 0.11 and 0.10 more performance than pure Morkaraman ewes with respect to the number of lambs and number of lambs weaned per ewe lambing, respectively.

Like the production trais of ewes, KM/MK crossbred lambs performed higher means than Morkaraman lambs for both weaning weight and body weight at shearing time (Özsoy, 1982).

Fleece yield characteristics

In this study, the greasy and clean fleece weights obtained from both pure breeds and KM and MK crosses, fall considerably below the reported value of 6.36 kg for the initial greasy flecee weight in Karacabey Merinos (Özcan et al., 2004) and also are comparable to the figures of 2.84 kg reported by Dellal et al. (2000) for Anatolian Merinos and 2.76 kg repotted by Düzgüneş and Pekel (1968) for Malya breed without significant deviation are lower the 3.57 value reported for Anatolian Merinos by Tuncer and Cengiz (2018), exceeds the reported values of 2.364 (Çolakoğlu and Özbeyaz, 1999) and 1.47-1.71 kg (Anonim, 1996) for Malya breed.

Milk yield traits

Morkaraman sheep breed is highly suited for enduring long, harsh winter seasons and periods of malnourishment in eastern Anatolia, while also exhibiting exceptional meat production. In addition to this, in all provinces where Morkaraman sheep are raised, their milk is used to produce cheese, butter, and dairy products such as yogurt. This study showed that Morkaraman breed has a lactation milk yield ranging between 79.4-81.4 kg, while Merinos breed yields 65.5 kg and their crosses yield 74.7 kg and also the lactation periods for each breed are 141, 109 and 135 days, respectively. The lactation milk yield values given by Özyürek (2020) and Dayıoğlu et al. (1995) in Erzurum province from Morkaraman breed was higher than the values by Küçük et al.(2000) in Van province. However, it was lower than the value reported by Kırmızıbayrak et al.(2005), longer than 88.9 days repotted by Özyürek (2020), shorter than 152 days reported by Küçük et al.(2000) and 152.9 day reported by Dayıoğlu et al.(1995). The milk yield and latation duration values obtained from crosses between Merino and Morkaraman sheep are found to be lower than the 99 kg and 141 day values previously reported by Yılmaz and Altunel (2013) for Turkish Merinos.

Live weight

Weaning and post-shearing body weights for pure breeds and crossbreeds in Karacabey Merinos (Özcan et al., 2004) are lower than those reported, but higher than those reported by Aktaş et al.(2016) central Anatolian Merinos. An attempt is made to integrate meat yield and fleece characteristics of Merino breed with the adaptive features of local breeds through crossbreeding. In general, it is understood that fleece yields and body weights of Merino*Morkaraman crosses obtained in this study are at the same level with those of domestic breeds containing Merinos genotype improved in Türkiye.

Fertility

While the number of ewes lambing per ewe mated and the number of lambs born per ewe mated in Morkaraman are lower than the values reported by Laçin and Aksoy (2003) in Kars province, the number of ewes lambing, lambs born and lambs weaned per ewe mated in crossbred genotypes are found to be very close to the values reported for central Anatolian Merinos (Savaş et al., 2020; Kırbaş et al., 2022), but lower than the values reported for Karacabey Merinos (Ekiz et al. 2005). On the other hand, the number of lambs born and the number of lambs weaned per ewe lambing are found to be higher in the Konya Merino flock than those obtained in crossbred genotypes in that study (Ünal, 1998). In comparison with Malya breed, the number of ewes lambing per ewe mated and the number of lambs born and lambs weaned per ewe lambing were higher than the results of that study (Çolakoğlu and Özbey, 1999; Güney, 1971).

Genetic parameters

Genetic parameters are shown in Table 8, 9 and 10. The heritability, repeatability, phenotypic and genetic correlation estimates for the characteristics have been calculated by using the data adjusted for statistically significant environmental factors.

Table 8. Heritabilities on diagonal, genetic correlation below diagonal and phenotypic correlations above diagonal for some production characteristics of Merino ewes

	GFW	CFW	FD	SL	BW	E_{CEJ}	L_{BEL}	L_{WLB}
Greasy fleece weight(GFW)	0.58±0.18	0.85±0.02	0.24±0.04	0.43±0.04	0.12±0.06			
Clean fleece weight (CFW)	0.89±0.04	0.38±0.15	0.21±0.04	0.46±0.04	0.04±0.06			
Fibre diameter (FD)	0.43±0.24	0.65±0.34	0.13±0.10	0.19±0.04	0.07±0.06			
Staple length (SL)	0.68±0.10	0.59±0.18	0.18±0.38	0.45±0.16	-0.02±0.06			
Body weight (BW)	0.10±0.05	0.14±0.07	0.09±0.69	-0.10±0.05	0.11±0.12			
E_{CEJ}						-0.071±0.053		
L_{BEL}							0.126±0.024	
L_{WLB}								0.047±0.029

Table 9. Heritabilities on diagonal, genetic correlation below diagonal and phenotypic correlations above diagonal for some production characteristics of Morkaraman

	GFW	CFW	FD	SL	BW	MY	MMY	AMY	BFY	LP
Greasy fleece weight(GFW)	0.30±0.17	0.93±0.06	--	0.25±0.05	0.10±0.05					
Clean fleece weight (CFW)	1.59±0.88	0.35±0.20		0.25±0.05	0.13±0.05	-0.14±0.04				
Fibre diameter (FD)	--	--	--							
Staple length (SL)	0.09±0.54	0.05±0.53		0.25±0.16	-0.06±0.05	-0.12±0.04				
Body weight (BW)	-0.61±0.36	-0.95±0.61		0.28±0.50	0.26±0.16	-0.01±0.04				
Milk yield (MY)	0.94±0.61	1.36±0.42		0.58±0.32	0.19±0.49	0.29±0.19			0.93±0.05	0.68±0.04
Maximum milk yield (MMY)							0.29±0.19			
Average milk yield (AMY)								0.27±0.18		
Butter fat yield (BFY)						0.96±0.30			0.35±0.21	
Lactation period (LP)						1.38±0.69				0.03±0.08

Heritability and genetic correlation estimates were obtained by paternal half-sib correlation (Table 8-9) and an intra-class correlation method was used for estimating the repeatability of estimates (Table 10). One can conclude that greasy fleece weight, clean fleece weight and stable length are moderately heritable characteristics in Merino population. But this is not true for fibre diameter and body weight at shearing. Meanwhile, in addition to heritability and repeatability estimates, taking genetic and phenotypic correlations among the traits into consideration, one could explore an effective breeding plan for the selection on greasy fleece weight recorded at first shearing.

Table 10. Repeatability estimates for some production characteristics of Merino and Morkaraman ewes

Characteristics	Repeatability	
	Merino	Morkaraman
Greasy fleece weight	0.63±0.05	0.52±0.04
Clean fleece weight	0.59±0.05	0.40±0.05
Fibre diameter	0.31±0.07	
Staple length	0.41±0.06	0.56±0.04
Body weight	0.62±0.05	0.64±0.04
Milk yield		0.73±0.04
Maximum daily milk yield		0.40±0.06
Average daily milk yield		0.47±0.05
Butter fat yield		0.75±0.03
Lactation period		0.47±0.05
E_{CEJ}		
L_{BEL}	0.098±0.053	0.103±0.032

For the reproduction traits, rams could be selected depending on the first two or three production records of their progeny with respect to number of lambs born per ewe lambing and these rams could be evaluated by their progeny or by their progeny production. Also, a selection plan can be applied for production and reproduction traits and a small increase might be expected for the traits considered in the selection of Merino flock.

On the other hand, the estimates of the heritabilities, except for greasy and clean fleece weights, of the other traits in Morkaraman sheep may be accepted low in values. Even if a moderate advance could be gained from selection practices, because of the phenotypic means for greasy and clean fleece weight are low, it can not be expected to obtain an adequate advance from selection practices for the mean of the next generation. Therefore, it is not convenient to apply a selection practice for such traits in pure Morkaraman ewes in near future.

CONCLUSION

Consequently, it could be concluded that the pure Merino and Morkaraman sheep breeds have not demonstrated satisfactory performance under the environmental conditions of eastern Anatolia. Nevertheless, it has been observed that certain genotypes and crossbred offspring, resulting from the crossbreeding of Merino with the native Morkaraman sheep breed have exhibited a higher potential for meat and satisfactory production traits, particularly in eastern Anatolia.

In the eastern part of Türkiye, some researchers have highlighted that crossbred genotypes resulting from Merino*Morkaraman crossing exhibit better performance than native püre Morkaraman, especially concerning the considered characteristics.

It also appears possible to enhance sheep productivity by establishing a new Morkaraman flock through the controlled mating of the members from a combination of these crosses. Implementing a selection program for specific criteria can further contribute to this development.

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Conflict of Interest

The article authors declare that there is no conflict of interest between them.

Author’s Contributions

The authors declare that they have contributed equally to the article.

REFERENCES

Aktaş A., Dursun, Ş., Halıcı, İ., Demirci, U., Akil, K., & Büyükbaş, l (2016). Mature Live Weights and Some Reproductive Characteristics of Orta Anadolu Merinosu Sheep under Breeder Conditions. *Journal of Tekirdag Agricultural Faculty*, 13(3), 13 - 19.

Altın, T., Karaca, O., Cemal, İ., Yılmaz, M., & Yılmaz O. (2005). The Fattening and Carcass Characteristics of Kıvırcık and Karya Lambs. *Animal Production*, 46(1), 19-29.

Anonim, (1996). T.İ.G.E.M, Malya Tarım İşletmesi Müdürlüğü Kayıtları. Boztepe -Kırşehir.

Çolakoğlu, N., & Özbeyaz, C. (1999). Comparison of Some Production Traits in Malya and Akkaraman Sheep. *Turkish. Journal of Veterinary Animal Sciences*, *23*, 351-360.

Dayıoğlu, H., Doğru, Ü., & Esenboğa, N (1995). *Süt Protein Tipleri İle Koyunların Laktasyon Özellikleri ve Kuzuların Büyüme Karakteristikleri Arasındaki İlişkiler*. TUBİTAK VHAG-1030 nolu proje kesin raporu.

Dellal, G., Söylemezoğlu, F., Etikan, S., & Erdoğan, Z (2000). Investigation of Some Physical and Morphological Characteristics of Wool of Malya Sheep. *Journal of Agricultural Sciences*, *6*(02), 48-53.

Duncan, D. B., (1955). Multiple range and multiple F test. *Biometrics,* 11(1), 1-42. https://doi.org/10.2307/3001478.

Düzgüneş, O & Pekel, E. (1968). Orta Anadolu şartlarında Çeşitli Merinos x Akkaraman Melezlerinin Verimle İlgili Özellikleri Üzerinde Mukayeseli Araştırmalar. *Ank. Üniv. Ziraat Fakültesi Yayınları*: 312, 1968; Ankara.

Ekiz, B., .Özcan, M., Yılmaz, A., & Ceyhan, A. 2005. Türk Merinoslarında (Karacabey Merinosu) Koyun Verimliliği Özelliklerine Ait Fenotipik ve Genetik Parametre Tahminleri. *Turk J Vet Anim Sci* 29 (2), 557-564.

Filya, İ., Ak, İ., Karabulut, A., Koyuncu, M., & Akgündüz, V. (1995). Determining of Fattening Performance of Mutton Breed*Merino Crossbred (F_1) Lambs. *Uludağ Üniv. Ziraat Fak. Derg*., 11 (1), 155-164.

Güney, O (1971). Malya ve Anadolu Merinoslarının Normal Bakım ve Yemleme Şartlarında Mukayesesi. Çayır-Mera ve Zootekni Araş. Enst. Yayın No: 17, 1971; Ankara

Harvey, W. R. (1977). User's guide for LSML76: Mixed model least-squares and maximum likelihood computer program. Ohio State University.

Karataş, Ş. (1973). *Comparison of Merino*Morkaraman Genotypes for Some Traits*. Atatürk University Agriculture Faculty, TÜBİTAK VHAG-23/51 d Project Final Report, Erzurum

Kaymakçı, M., & Taşkın, T. (2008). Sheep Crossbreeding Studies in Türkiye. *Hayvansal Üretim*, 49(2), 43-51.

Kırbaş M, Bülbül B, & Kal, Y., (2022). Some reproductive traits in central Anatolian merino sheep under breeder conditions. . *Journal of Advances in Vetbio Science and Techniques*, 7(1), 14 - 18. 10.31797/vetbio.1018631

Kırmızıbayrak, T., Aksoy, A., Saatcı, M., & Tilki, M (2005). Tuj ve Morkaraman Koyunların Süt Verimi ve Meme Özellikleri İle Bu Özellikler Arasındaki İlişkiler. *Kafkas Üniversitesi Veteriner Fakültesi* Dergisi, 11(1), 11 - 15.

Köprücü, E. (1974). *The Estimation of Reproduction Traits of Atatürk University Merino and Morkaraman Flock*. (Unpressed Doctoral Thesis). Atatürk University Agriculture Faculty Animal Science Department, Erzurum.

Küçük, M., Öztürk, Y., & Bayram, D (2000). Yarı-entansif şartlarda Hamdani, Karagül ve Morkaraman koyunlarının süt verimi özelliklerinin karşılaştırılması. *Yüzüncü Yıl Üniversitesi Veteriner Fakültesi Dergisi*, 11(1), 44 - 48.

Lacin, E, & Aksoy, A.R. (2003). Kars Bölgesinde Yetiştirilen Morkaraman ve Tuj Koyunlarının Döl Verimi Özelliklerinin Karşılaştırılması. *Kafkas Üniversitesi Veteriner Fakültesi Dergisi*, 9(1), 5 - 7.

Özcan, M., Yılmaz, A., Ekiz, B., & Ceyhan, A (2004). The Effects of Some Environmental Factors Affecting on The Growth And Greasy Fleece Yield at First Shearing of Turkish Merino (Karacabey Merino) Lambs. *İstanbul Üniversitesi Veteriner Fakültesi Dergisi*, 30(2), 159 - 167.

Özsoy, M.K. (1974). *The Estimation of Some Parameters Wool Traits of Atatürk University Merino Flock*. (Unpressed Doctoral Thesis). Atatürk University Agriculture Faculty Animal Science Department, Erzurum.

Özsoy, M.K., & . Vanlı, Y (1985). *Merinos, Morkaraman ve Ivesi ırkları ile bunların iki-ırk melezlerinin koyun verim özellikleri bakımından değerlendirilmesi*. Atatürk University Agriculture Faculty, TÜBİTAK VHAG-626. Project Final Report, Erzurum

Özsoy, M.K., (1982). *Merinos x Morkaraman x İvesi üçlü melez kuzuların verim özellikleri üzerine karşılaştırmalı araştırma*. Atatürk University Agriculture Faculty, TÜBİTAK VHAG-300. Project Final Report, Erzurum

Özyürek, S (2020). Investigation of Relationship between Udder Morphology, Lactation Traits and Milk Components in Morkaraman and Awassi. *Gümüşhane Üniversitesi Fen Bilimleri Dergisi*, 10(1), 268 - 274. 10.17714/gumusfenbil.630056

Savaş, İ., Yılmaz, İ & Yanar, M (2020). Some Reproductive Traits of Morkaraman Sheep Breeds Raised in Semi Nomadic Livestock Activities. *International Journal of Agriculture and Wildlife Science*, 6(1), 100 - 107. 10.24180/ijaws.637369

Sönmez, R., Kaymakçı, M., Eliçin, A., Tuncel, E., Wassmuth, R., & Taşkın, T. (2009). Improvement Studies in Türkiye Sheep Husbandry. *Uludağ Üniversitesi Ziraat Fakültesi Dergisi,* 23(2), 43-65. Retrieved from https://dergipark.org.tr/en/pub/ ziraatuludag/issue/ 16754/174183

Taşkın, T., Özder, M., Atıl, H., & Kaymakçı, M., (1999). Suffolk X B.Leicester X Merinos Melezi Kuzularda Besi ve Karkas Özellikleri Arasındaki Fenotipik Korelasyonlar. *Tr. J. Veterinary And Animal Sciences*. 23 (1), 203-208.

Taşkın., T., Kaymakçı, M., Sönmez, R, Yılmaz, M., & Bardakçıoğlu, E., (2012). Genetic and Non-Genetic Parameter Estimates For Growth Traits Of Sonmez Lambs. *Veterinarija İr Zootechnika (Vet Med Zoot).* 60(82), 79-83.

TUİK (2022). Animal Production Statistics, 2022. TUİK Newsletter 09 February 2023. https://data.tuik.gov.tr/Bulten/Index?p=Hayvansal-Uretim-Istatistikleri-2022-49682

Tuncer, S., & Cengiz, F (2018). Fleece Yield and Characteristics in White karaman, Anatolian Merino, Ile de France X White Karaman (G_1) and Ile de France X Anatolian Merino (G_1) Crossbreds. *Yuzuncu Yıl University Journal of Agricultural Sciences*. 28(3), 353 - 357. 10.29133/yyutbd. 419370

Üçtepe, A (2016). Quantitative Consideration of Cross Breeding Studies Conducted in Turkey to Improve Fattening Features in Sheep. *Journal of Tekirdag Agricultural Faculty,* 13(2), 75 - 84.

Ünal, N. (1998). *Orta Anadolu Merinoslarında Önemli Verim Özellikleri Ve Bunların Geliştirilmesi İçin Bir Seleksiyon İndeksinin Hesaplanması*. Ankara Üniversitesi Sağlık Bilimleri Enstitüsü, (basılmamış doktara tezi)

Vanlı, Y. (1974). *Genetic and Phenotypic Parameters for Fleece and Milk Characteristics in Atatürk University Morkaraman Flock*. (Unpressed Doctoral Thesis). Atatürk University Agriculture Faculty Animal Science Department, Erzurum.

Yılmaz, A., & Altınel, A. (2013). The effects of some environmental factors affecting on the milk production and growth characteristics of the German Black-Headed Mutton x F j (Chios x Kıvırcık) crossbreds in comparison with Kıvırcık and Turkish Merinos. *J. Fac. Vet. Med. Istanbul Univ, 29*(2), 259-266..