COMPARISON OF THE IMPORTANT PRODUCTION TRAITS OF TURKISH MERINO AND INDIGENOUS KIVIRCIK SHEEP BREEDS

Ahmet ALTINEL* Halil GÜNEŞ* Alper YILMAZ*
Turgut KIRMIZIBAYRAK* Vedat AKGÜNDÜZ**

Türk Merinosu ve Kıvırcık Irkı Koyunların Önemli Verim Özellikleri Yönünden Karşılaştırılması

Özet: Uzun yıllar süren çalışmalar sonunda elde edilen Türk Merinosu ve bu ırkın elde edilmesinde anaç materyal olarak kullanılan ırklardan biri olan Kıvırcık koyunların verim düzeylerinde, aradan geçen yıllar boyunca her iki genotip üzerinde sürdürülen seleksiyon ve değişen bakım-besleme koşullarına bağlı olarak, değişiklikler ortaya çıkabilecektir. Bu araştırmada, aynı ortamda birlikte yetiştirilen Türk Merinosu ve Kıvırcıkların yarı-entansif koşullardaki önemli verim özelliklerine ait düzeylerin belirlenmesi ve 1930'lu yıllarda başlayan Merinoslaştırma çalışmaları sonucunda ne düzeyde bir gelişme kaydedildiğinin belirlenmesi, temel amaç olarak alınmıştır.

Araştırmaya alınan Kıvırcık ve Türk Merinosu koyunlarında östrus oranı %91.95 ve %93.33, gebelik oranı %74.41 ve %80.00, ikizlik oranı %41.27 ve %48.61, bir doğuma düşen kuzu sayısı 1.48 ve 1.49 (Kıvırcıklarda %3.17 üçüz doğum) olarak, Kıvırcık ve Türk Merinosu kuzuların 105. ile 180. gün dönemine kadar yaşama güçleri %89.13 ve %93.27 ile %84.78 ve %89.42 düzeylerinde belirlenmiş ve bu özellikler için iki ırkın değerleri arasındaki farklılıklar istatistik bakımından önemsiz bulunmuştur. Koyunların süt verimi, laktasyon süresi ve tohumlama öncesi canlı ağırlıkları Kıvırcıkların 82.85 kg, 135.28 gün ve 52.93 kg, Türk Merinoslarının 97.02 kg, 140.89 gün ve 65.41 kg olarak saptanmış ve genotipler arasındaki farklılıklar istatistik bakımından önemli bulunmuştur ($P < 0.05$). Kuzuların doğum, 105. ve 180. gün canlı ağırlıkları Kıvırcıklar için 3.68 kg, 26.14 kg ve 35.33 kg, Türk Merinosları için 4.75 kg, 30.37 kg ve 41.83 kg düzeylerinde olduğu saptanmış ve genotipler arasındaki farklılıklar istatistik bakımından önemli ($P < 0.05$) olarak belirlenmiştir.

Araştırmada süt verimi ve kuzuların gelişimi bakımından Merinoslar Kıvırcıklara karşı belirgin üstünlük sağlamışlardır. Bu sonuca göre, incelenen özellikler için Türkiye'deki Merinoslaştırmanın hedefine ulaştığı ifade edilebilir.

Anahtar Kelimeler: Türk Merinosu, Kıvırcık, ırklar, verim özellikleri.

Summary: There could have been some differences, on the production traits of Turkish Merino Sheep Breed which was formed by long years of work and Kıvırcık Sheep Breed which was used as dam line in the formation of Turkish Merino, due to selection on both breeds and the changes on animal nutrition practices and management, in the past years. The main aims of this study were taken as to determine the production traits of Turkish Merino and Kıvırcık Sheep Breeds raised together semi-intensively, in similar environmental conditions and to determine the progress level of these two breeds after the crossbreeding studies which was carried out since 1930's in the form of upgrading indigenous Kıvırcık Sheep Breed to Turkish Merino Sheep Breed.

---

* İ.Ü. Veteriner Fakültesi, Zootekni Anabilim Dalı, 34851, Avcılar/İstanbul

** Marmara Hayvancılık Araştırma Enstitüsü, Bandırma

Kıvırcık and Turkish Merino Sheep taken in this research showed 91.95% and 93.33% oestrus rates, 74.41%, 80.00% conception rates, 41.27%, 48.61% twinning rates (Kıvırcık Sheep showed 3.17% tripling rate), litter size was 1.48 and 1.49, age at weaning (105 days) and 180 days survival rates of Kıvırcık and Turkish Merino lambs were found as 89.3% and 93.27%, 84.78% and 89.42%, respectively and the differences between the two breeds for these traits were found statistically non-significant. Milk yield, lactation length and weight before mating for Kıvırcık Sheep were 82.85 kg, 135.28 days and 52.93 kg and for Turkish Merino Sheep, these traits were 97.02 kg, 140.89 days and 65.41 kg, respectively and the differences between the genotypes were found statistically significant ($P < 0.05$). Birth, age at weaning (105 days) and 180 days live weight for Kıvırcık lambs were 3.68 kg, 26.14 kg and 35.33 kg and for Turkish Merino lambs these traits were 4.75 kg, 30.37 kg and 41.83 kg, respectively and the differences between the genotypes were found statistically significant ($P < 0.05$).

In this study Turkish Merino Sheep showed barely better performance for milk yield and lamb growth compared to Kıvırcık Sheep. Due to this result, for the traits taken in this study, it can be declared that upgrading indigenous Kıvırcık Sheep Breed to Turkish Merino Sheep Breed has been a successful study and has reached its aims.

Keywords: Turkish Merino, Kıvırcık, breeds, production traits.

Introduction

The sheep population of Turkey, which is 37.5 million, has an important place in the total animal population of Turkey (4). With this sheep population, Turkey is at the 7th place among the sheep breeding countries of the world (7). Turkey's 10.1% (1 047 000 tons) of milk production and 26.1% (112 800 tons) of meat production is provided by sheep breeding (4). The geographical and weather conditions of Turkey are the most important reasons why sheep breeding is preferred. Range lands which can not be used for agriculture is utilized in the most profitable way by sheep breeding.

The vegetation at pastures in the Middle and East Anatolia Regions of Turkey is weak and low quality because of the harsh weather conditions. However, in the western parts of Turkey, Marmara and Ege Regions are more suitable for semi-intensive sheep breeding as the weather at these regions is milder and pasture quality is better. The widespread sheep breeds at Marmara Region are Kıvırcık and Turkish Merino Sheep Breeds. There are 2.5 million Kıvırcık Sheep and 0.3 million Turkish Merino Sheep in this region (4).

In the western parts of Turkey, especially in Thrace, sheep milk is mostly used for making a special kind of white cheese (Edirne white cheese) which is very popular in Turkey. Most of the lambs are weaned as early as at one and a half months of age, so that ewes can be milked longer and the majority of the lambs are slaughtered without further fattening. In this

way, meat production potential of these lambs is poorly utilized. The quality of Kıvırcık meat is considered to be the best among local and imported breeds as it has a good marbling. Besides Turkey, Kıvırcık Sheep breed is also bred in Bulgaria and Greece especially at western Thrace parts and is called as Thraki Sheep (26).

Studies on improving the production traits of indigenous Kıvırcık Sheep have been carried out since the foundation of Turkish Republic. After the year 1934, German Mutton Merino rams were brought to Turkey in order to improve the body performance and fleece quality of Kıvırcık Sheep. The ewes produced from crossbreeding Kıvırcık Sheep with German Mutton Merino rams were mated backwards to German Mutton Merino rams for 4-5 generations in the form of upgrading. Crossbreeding was done by artificial insemination. Selections were applied on the 3rd, 4th and 5th crossbred rams and ewes for fleece quality and growth performance. The backwards crossbred rams and ewes to German Mutton Merino Sheep were raised together and the first Turkish Merino type called Karacabey Merino Sheep Breed was produced. This crossbreeding study was carried out on both Karacabey (Bursa) State Farm and on Kıvırcık sheep raised by private breeders around Bursa and Balıkesir cities, after 1935. Between 1935-1940, 620.000 Kıvırcık sheep were artificially inseminated with German Mutton Merino semen. For these years, Turkey was the second country in the world to use widespread artificial insemination on sheep. After 1952 crossbreeding with German Mutton Merino was also carried out at Konya on indigenous White Karaman Sheep Breed. These studies has been applied until a sheep breed with 80% German Mutton Merino Sheep genotype and 20% White Karaman Sheep genotype called Central Anatolian Merino Sheep has been produced (26). Later on, both Karacabey Merino and Central Anatolian Merino Sheep Breeds were named as Turkish Merino Sheep Breed.

In different studies carried out to show the production performance of Kıvırcık Sheep in Turkey, oestrus rates were 91.0-99.3%, conception rates were 76.1-89.9%, birth rates were 74.6-95.7%, twinning rates were 4.1-41.0%, litter sizes were 1.04-1.43, survival rates at weaning were 96.6-99.2%, survival rates at 180 days were 93.0-98.6%, milk yields per lactation were 56.0-82.4 kg and lactation lengths were 147.4-191.0 days (2, 3, 14, 21, 22, 23, 24). In the studies which lamb growth was inspected, birth weight, weight at weaning, weight at 180 days of lambs and adult live weight of ewes were found 3.5-4.3 kg, 18.2-27.1 kg and between 23.2-37.5 kg and 38.3-52.7 kg, respectively (2, 3, 6, 14, 15, 21).

In the studies carried out on Turkish Merino Sheep, oestrus rate was 93.1%, conception rates were 81.5-91.2%, birth rates were 79.5-87.7%, twinning rate was 7.6%, litter sizes were 1.04-1.45, survival rates of lambs at weaning were 82.9-94.6%, at 180 days was 93.3%, milk yields per lactation were 50.0-70.0 kg and lactation lengths were 130.0-140.0 days (1, 11, 12, 13, 26). Live weights of this breed at different ages were 3.25-5.27 kg at birth, 15.7-38.3 kg at weaning, 22.7-47.1 kg at 180 days, 50.6-62.6 adult live weight (1, 11, 12, 13, 16, 17).

In the studies carried to demonstrate the factors influencing the production performances of Kıvırcık Sheep and Turkish Merino Sheep, on growth performance, ewe's age, sex and birth type and on milk yield ewe's age were found statistically important (3, 6, 12, 14, 16, 22).

Comparison of the production performances of different sheep breeds in similar environmental conditions, will provide the understanding of the differences between the breeds in a more correct way. In order to determine the productive performances of Kıvırcık Sheep and Turkish Merino Sheep, some studies has been carried out during the crossbreeding period on different degree genotype groups and later on both breeds in different regions. However, there has not been a study on Kıvırcık Sheep and Turkish Merino Sheep bred under similar environmental conditions. This study's being carried out at Marmara Region where the two breeds have adapted the most and the two breeds' being managed in the same flock, will help to determine the differences of productive performances of the two breeds in quantitative measures.

As meat consumption is increasing in Turkey, production of fast growing commercial crossbred slaughter lambs has been achieving more interest. For this reason, this study also has importance to determine the possibilities to use these two breeds for the production of commercial slaughter lambs and to determine which of the production traits of these two breeds should be improved and preserved.

In this study, the main aims have been taken as to determine the differences between the production performances of Turkish Merino Sheep which was produced after long years

of work and Kıvırcık sheep which was the dam line of the crossbreeding study, due to the changes of management and nutritional practices in the past years and to show the performance of the important production traits of these two breeds raised in similar, semi-intensive environmental conditions. This study will also help to determine the success level of the long crossbreeding studies in the form of upgrading indigenous Kıvırcık Sheep to Merino Sheep, since 1930's.

Materials and Methods

This study has been carried out at Bandırma Sheep Research Institute. The records taken from 87 Kıvırcık and 90 Turkish Merino ewes and from their 92 Kıvırcık and 104 Turkish Merino lambs were used.

In this study, reproductive traits, milk yield and live weight before mating of ewes were investigated. For the reproductive traits of ewes, ewes showing oestrus, ewes pregnant, ewes giving birth and live born lamb rates were calculated by using number of ewes at mating, twinning and tripling rates, the number of mating necessary per conception and litter sizes were calculated by using the number of ewes which gave birth.

As milk production traits, milk yield in one lactation and lactation lengths were investigated. At milk control dates, lambs were not let to suckle. The formulation below was used to calculate milk yields.

$$M = [(A_1 - D) * k_1] + \sum_{i}^{n} \left[\left(\frac{k + k'}{2} \right) * (A' - A) \right] + [(S - A_n) * k_n]$$

Symbols in this formula show;

M	: Milk yield of any ewe in one lactation (kg)
A and A'	: Consecutive control dates (day)
k and k'	: Milk yields of consecutive controls (kg)
D	: Date of birth
S	: Drying out date.

Survival rates and growth of lambs at weaning (105 days) and 180 days were investigated. To investigate growth of lambs, data taken from weighing of lambs in 15 days intervals were used. In order to calculate 105 days and 180 days weights by using interpolation, the formula below was used.

$$X = \left[\left(\frac{A - A'}{B - B'} \right) * (C - B) \right] + A$$

Symbols in this formula show;

X : Estimated live weight (kg)

A and *A*' : Live weights at consecutive weighings (kg)

B and B' : Age at consecutive weighings (day)

C : Age at which live weight is wanted to be estimated (day).

Oestrus synchronization was not applied on ewes for mating. For the nutrition of ewes and lambs, the normal feeding program of the institute has been used and no other special management and feeding program has been used for Kıvırcık and Turkish Merino Sheep groups which were managed together in the same flock.

In order to find the effect ratio, the factors showing grouped variation and to find the ratio of environmental factors in general variation, materials tables which were grouped in various sides were used. Supposing there was not significant interaction between the factors inspected, factors' effect ratios were calculated by least squares means method (10). Statistical significance control of the differences among the average means was done by Duncan-test (5), control of the differences between the ratios was done by X^2 test (20) and control of the significance of the differences among the least squares means (LSM) was done by contrast-test indicated by Searle (18).

The effects of genotype, age and birth type on lactation length and milk yield and the effect of genotype and age on number of mating needed per conception and weights before mating were inspected. In the part where lamb growth was inspected, the effects of genotype, sex, birth type and ewe's age at birth, weaning (105 days) and 180 days live weights were inspected. For the statistical analyses of these traits the linear models below were used:

For lactation length and milk yield; $\mathbf{Y_{ijkl} = \mu + g_i + a_j + t_k + e_{ijkl}}$

For live weight of ewes; $\mathbf{Y_{ijk} = \mu + g_i + a_j + e_{ijkl}}$

For live weight of lambs at different ages ; $\mathbf{Y_{ijklm} = \mu + g_i + a_j + t_k + s_l + e_{ijklm}}$

Symbols in these models show;

Y_{ijklm} : Value of productive performance of any animal

μ : Expected average value level

g_i : Effect of genotype (*i*= Kıvırcık and Turkish Merino)

a_j : Effect of age of ewes (*l*=2,3,4,5,6 and 7)

t_k : Effect of birth type (*k*= Single, twin and triplet)

s_l : Effect of sex of lambs (*j*= male and female)

e_{ijklm} : Coincidence fault of any animal

For the analyses of characters inspected, general linear models (GLM) procedure from SAS™ program packet was used (8, 9, 10, 19, 25).

Results and Discussion

Reproductive Traits:

For ewes, in order to increase intensity of selection and to get more saleable breeding animals, a high reproductive productivity is needed. Reproductive performance, such as ratio of lambs born to ewes at mating can be taken in to consideration by three criteria. These are, rate of ewes which gave birth, number of lambs born from every 100 ewes and survival rates of lambs until weaning. Results of reproductive traits of Kıvırcık and Turkish Merino Sheep bred at Bandırma Sheep Research Institute are presented in Table 1.

In this study, 87 Kıvırcık and 90 Turkish Merino ewes were investigated and 80 (91.95%) and 84 (93.33%) respectively of these ewes showed oestrus and were mated. 72.41% of Kıvırcık and 80.00% of Turkish Merino ewes were pregnant and gave birth. There was no abortion in the flock. 41.27% of Kıvırcık and 48.61% of Turkish Merino ewes gave birth to twins. Three of Kıvırcık ewes (3.17%) gave birth to triplets. Litter size was found 1.48 for Kıvırcık and 1.49 for Turkish Merino ewes. For these traits inspected, the differences

between the values of the two breeds were found statistically non-significant (X^2-test). So it can be indicated that for reproductive traits Kıvırcık and Turkish Merino Sheep Breeds have similar values. However, for reproductive traits, the reason for Kıvırcık ewes being close to Turkish Merino ewes might be the number of older ewes being more in Kıvırcık ewes' group.

Table 1. Levels of reproductive traits of Kıvırcık and Turkish Merino Sheep Breeds.

Characters	Kıvırcık		Turkish Merino	
	Number of ewes	%	Number of ewes	%
Ewes present at mating	87	-	90	-
Ewes showing oestrus	80	91.95	84	93.33
Ewes pregnant	63	72.41	72	80.00
Ewes gave birth	63	72.41	72	80.00
Singles	35	55.56	37	51.39
Twins	26	41.27	35	48.61
Triplets	2	3.17	0	0.00
Litter size	1.48	-	1.49	-
Survival rates of lambs investigated	92	-	104	-
105 days	82	89.13	97	93.27
180 days	78	84.78	93	89.42

In this study, the percentage of ewes showing oestrus, ewes pregnant and ewes gave birth compared to the results in references were found near to the lower results (2, 3, 11, 12, 13, 14, 21, 22). The closest results given for both Kıvırcık and Turkish Merino Sheep are the results inspected at the same institute before by Altınel et al. (2) for Kıvırcık as 91.04%, 76.12% and 74.63% and by Oğan (12) for Turkish Merino as 93.08%, 81.53% and 79.51%, respectively. Twinning rate and litter size for Kıvırcık and Turkish Merino (41.27% and 48.61%; 1.48 and 1.49 respectively) were found higher than the other results given in references (2, 3, 11, 12, 13, 14, 21, 22, 23). These results show that environmental conditions at Bandırma region for these two breeds can be regarded as optimum level.

Survival rates of lambs at weaning (105 days) and at 180 days for Turkish Merino (93.27% and 89.42%) were found higher than Kıvırcık lambs (89.13% and 84.78%) but these differences were found statistically non-significant. The reason for the survival rates of Turkish Merino lambs being slightly higher might be the higher milk yield of Turkish Merino ewes.

Survival rates at the age of weaning (105 days) and at 180 days of Kıvırcık lambs were determined to be lower than given in references (14, 22, 23), survival rates of Turkish Merino lambs at these ages were found similar to references (1, 11, 12, 13).

Milk yield and lactation length:

Growth of lambs in the early ages is closely related to milk yield of ewes. Especially in Mediterranean, Balkan and Middle East countries, ewes' milk is consumed as fresh milk or as milk products like cheese and yogurt. Also in Turkey like most of the countries in the world most of the milk production is from cows' milk. On the other hand, most of the fresh milk and milk products needs of the people at rural places of Turkey, are produced by indigenous sheep breeds of Turkey.

Results of milk yield and lactation length of Kıvırcık and Turkish Merino ewes and the statistical controls of the differences of the subgroups formed by the investigated effects of genotype, age and birth type and the effect ratios of these factors on traits are presented in Table 2.

In this study, milk yield in one lactation of Kıvırcık and Turkish Merino ewes were found 82.85 kg and 97.02 kg, respectively. For both breeds, ewes at 4 and 5 years of age gave the peak milk yield but the differences for milk yield among the ewes at different ages and the ewes which gave birth to single or twin lambs were found statistically non-significant. Lactation length for Kıvırcık and Turkish Merino ewes were 135.28 and 140.89 days. For Kıvırcık ewes group, 4 and 5 years aged Kıvırcık ewes had the longest lactation and despite the 2 years old ewes, Turkish Merino ewes had similar lactation lengths. As in milk yield, for lactation length of the subgroups of the two breeds the differences were found statistically non-significant. But for milk yield and lactation length, the differences between the general results of Kıvırcık and Turkish Merino Sheep Breeds were found statistically significant ($P < 0.05$).

Milk yield results of Kıvırcık ewes given in this study are higher than the results given by Sönmez and Wassmuth (24), Sönmez and Kızılay (22), Özcan (14) and Sönmez et al. (23).

Lactation length found in this study is shorter than the other studies' results indicating this character. As Turkish Merino ewes are not usually milked, there are not much studies on this trait. Milk yield and lactation length results of this study are higher than the results given by Yalçın (26). These results might show that ewes can be milked if lambs are weaned at earlier ages.

Table 2. Levels of milk yield traits of Kıvırcık and Turkish Merino Sheep Breeds and effect ratios (ER) of investigated factors.

Factors		Kıvırcık			Turkish Merino			General	
		n	$\bar{x}$	$s_{\bar{x}}$	*n*	$\bar{x}$	$s_{\bar{x}}$	*n*	*ER*
Milk yield (kg)									
Genotype	Kıvırcık	50	82.85[b]	4.232				50	-9.836[b]
	T.Merino				62	97.02[a]	3.421	62	9.836[a]
Age	2	5	54.87[a]	10.926	16	83.74[a]	4.582	21	-16.172[b]
	3	4	70.51[a]	9.452	14	92.64[a]	7.349	18	-6.547[ab]
	4	23	89.23[a]	5.247	11	105.34[a]	6.860	34	8.865[a]
	5	6	93.12[a]	5.236	12	106.99[a]	7.795	18	9.045[a]
	6	9	84.76[a]	15.752	4	101.53[a]	16.233	13	4.139[a]
	7	3	70.66[a]	14.278	5	105.98[a]	19.358	8	0.670[ab]
Birth type	Singles	27	76.16[a]	5.068	29	93.80[a]	4.574	56	-2.223[a]
	Twins	23	90.69[a]	6.774	33	99.86[a]	5.028	56	2.223[a]
μ								112	89.051
Lactation length (days)									
Genotype	Kıvırcık	50	135.28[b]	2.223				50	-3.676[b]
	T.Merino				62	140.58[a]	1.517	62	3.676[a]
Age	2	5	123.80[a]	7.446	16	135.06[a]	3.496	21	-7.258[b]
	3	4	125.25[a]	5.977	14	143.21[a]	3.510	18	-0.251[ab]
	4	23	139.78[a]	2.729	11	143.09[a]	2.613	34	4.795[a]
	5	6	147.00[a]	5.797	12	139.42[a]	2.542	18	3.668[a]
	6	9	127.56[a]	5.541	4	146.25[a]	5.360	13	-2.476[ab]
	7	3	133.00[a]	10.599	5	143.60[a]	6.055	8	1.522[ab]
Birth type	Singles	27	134.67[a]	3.207	29	140.52[a]	2.549	56	0.685[a]
	Twins	23	136.00[a]	3.099	33	140.64[a]	1.801	56	-0.685[a]
μ								112	137.355

[a,b] : In each of the subgroups, means followed by different superscripts differ significantly ($P < 0.05$).

At flock basis, expected averages were found by statistical analysis of milk yield and lactation length as 89.051 kg and 137.355 days, respectively. Milk yield for Kıvırcık ewes was 9.836 kg less and for Turkish Merino ewes it was this amount higher than the expected

average. Lactation length for Kıvırcık ewes was 3.676 days shorter and for Turkish Merino ewes it was 3.676 days longer than the expected average. The differences between Kıvırcık and Turkish Merino Sheep Breeds 19.672 kg for milk yield and 7.508 days for lactation length were found statistically significant ($P < 0.001$ and $P < 0.01$).

Determination degrees (R^2) of genotype, age and birth type on milk yield and lactation length was calculated as 18.26% and 12.87%, respectively. Single or twin birth types did not have significant effects on both traits. Age, had significant effect on milk yield ($P < 0.05$) but did not have significant effect on lactation length. Breed factor's ratio at general variation being 9.33% for milk yield ($P < 0.001$) and 5.66% ($P < 0.01$) for lactation length, shows the superiority of Turkish Merino Sheep Breed compared to indigenous Kıvırcık Sheep Breed.

Growth of lambs:

In sheep breeding, live weight is an important characteristic of ewes because of its relation with the reproductive performance of ewes and growth and survival rates of lambs. For these reasons, for the lamb to have a satisfactory growth, the growth period from birth to first mating of the ewe has a special significance. Birth weight, live weight at weaning (105 days) and 180 days of Kıvırcık and Turkish Merino lambs, the statistical controls of the subgroups formed by the investigated effects of genotype, sex, birth type and age of ewe and the effect ratios of these factors on traits are presented in Table 3.

Birth weight, live weight at weaning (105 days) and 180 days for Kıvırcık lambs were 3.68 kg, 26.14 kg and 35.33 kg and for Turkish Merino lambs were 4.75 kg, 30.37 kg and 41.83 kg, respectively. Effect of sex factor being non-significant for birth weight, showed progress on the male side towards 105 days and 180 days. For growth, birth type was found significant for both breeds. Effect of ewe's age on growth of lambs showed difference in different periods. The differences between the general results of birth weight, live weight at 105 days and 180 days of Kıvırcık and Turkish Merino lambs were found statistically significant ($P < 0.05$).

Table 3. Live weight of Kıvırcık and Turkish Merino lambs at different ages and effect ratios (ER) of investigated factors.

Factors		Kıvırcık			Turkish Merino			General	
		n	$\bar{x}$	$s_{\bar{x}}$	*n*	$\bar{x}$	$s_{\bar{x}}$	*n*	*ER*
Birth weight (kg)									
Genotype	Kıvırcık	92	3.68^{b}	0.077				92	-0.553^{b}
	T.Merino				104	4.75^{a}	0.086	104	0.553^{a}
Sex	Males	43	3.80^{a}	0.121	51	4.80^{a}	0.126	94	0.017^{a}
	Females	49	3.58^{a}	0.098	53	4.69^{a}	0.119	102	-0.017^{a}
Birth type	Singles	34	4.07^{a}	0.102	36	5.21^{a}	0.166	70	0.754^{a}
	Twins	52	3.55^{b}	0.092	68	4.50^{b}	0.086	120	0.057^{b}
	Triplets	6	2.58^{c}	0.290				6	-0.811^{c}
Ewe's age	2	7	3.80^{ab}	0.193	23	4.60^{a}	0.160	30	-0.305^{b}
	3	5	4.38^{a}	0.215	24	4.66^{a}	0.184	29	-0.027^{ab}
	4	43	3.88^{ab}	0.092	20	4.73^{a}	0.228	63	0.204^{a}
	5	12	3.38^{bc}	0.177	21	4.82^{a}	0.170	33	0.032^{ab}
	6	18	3.18^{c}	0.234	6	4.88^{a}	0.575	24	-0.117^{ab}
	7	7	3.66^{bc}	0.178	10	5.06^{a}	0.222	17	0.213^{a}
μ								196	3.909
Weaning (105 days) live weight (kg)									
Genotype	Kıvırcık	75	26.14^{b}	0.659				75	-2.240^{b}
	T.Merino				94	30.37^{a}	0.648	94	2.240^{a}
Sex	Males	36	28.03^{a}	1.023	44	32.63^{a}	0.938	80	1.546^{a}
	Females	39	24.40^{b}	0.754	50	28.39^{b}	0.805	89	-1.546^{b}
Birth type	Singles	26	28.42^{a}	1.111	34	33.62^{a}	1.037	60	5.123^{a}
	Twins	43	25.90^{a}	0.762	60	28.54^{b}	0.734	103	1.126^{b}
	Triplets	6	18.03^{b}	0.949				6	-6.249^{c}
Ewe's age	2	4	23.67^{a}	1.532	20	30.42^{ab}	1.144	24	-1.105^{ab}
	3	4	26.66^{a}	1.549	24	29.81^{ab}	1.008	28	-0.530^{ab}
	4	40	27.30^{a}	0.895	17	30.45^{ab}	1.759	57	1.447^{a}
	5	10	26.90^{a}	1.523	18	31.27^{ab}	1.920	28	1.302^{a}
	6	11	23.51^{a}	2.291	6	33.34^{a}	1.805	17	1.293^{ab}
	7	6	23.34^{a}	1.906	9	27.88^{b}	2.410	15	-2.407^{b}
μ								169	25.667
180 days live weight (kg)									
Genotype	Kıvırcık	74	35.33^{b}	0.848				74	-3.677^{b}
	T.Merino				83	41.83^{a}	0.761	83	3.677^{a}
Sex	Males	35	38.59^{a}	1.211	38	45.87^{a}	0.985	73	2.866^{a}
	Females	39	32.40^{b}	0.983	45	38.42^{b}	0.852	84	-2.866^{b}
Birth type	Singles	25	37.54^{a}	1.570	31	45.55^{a}	1.139	56	5.252^{a}
	Twins	43	35.16^{a}	1.011	52	39.62^{b}	0.880	95	0.977^{b}
	Triplets	6	27.34^{b}	1.302				6	-6.229^{c}
Ewe's age	2	4	28.76^{b}	2.900	18	41.86^{ab}	1.872	22	-1.730^{bc}
	3	4	33.03^{ab}	1.049	21	40.47^{ab}	1.077	25	-1.398^{bc}
	4	40	36.69^{a}	1.211	14	43.76^{a}	1.764	54	2.397^{a}
	5	10	37.02^{a}	1.884	17	42.17^{ab}	2.100	27	1.327^{ab}
	6	10	32.66^{ab}	2.611	6	44.75^{a}	1.942	16	2.094^{ab}
	7	6	33.74^{ab}	2.328	7	38.66^{b}	2.630	13	-2.690^{c}
μ								157	35.952

^{a,b,c} : In each of the subgroups, means followed by different superscripts differ significantly ($P < 0.05$).

In this study, birth weight of Kıvırcık lambs were similar to the results of the studies reported by Sönmez et al. (21), Özcan (14), Özcan and Akı (15), Evrim et al. (6), 105 days and 180 days live weights were found higher in this study. Live weight of Turkish Merino lambs at these ages were found similar to that declared by Örkiz (13), Akçapınar (1), İmeryüz (11), Readi (16), for birth weight, results were lower than Schmidt (17) and for 105 days and 180 days live weights results were lower than Oğan (12) indicated.

Statistical analysis in which all the lambs were considered, the expected averages calculated for birth weight was 3.909 kg, for live weight at weaning (105 days) was 25.667 kg and for 180 days was 35.952 kg. The difference between Kıvırcık and Turkish Merino lambs for birth weight was 1.106 kg, for live weight at weaning (105 days) was 4.480 kg and 180 days was 7.354 kg and these differences were found statistically highly significant ($P < 0.001$).

In this study, the general determination degrees of genotype, sex, birth type and ewe's age on birth weight, live weight at 105 days and 180 days were calculated as 46.51%, 36.54%, 49.08%, respectively. Sex's effect on birth weight and ewe age's effect on birth weight and live weight at 105 days were found statistically non-significant. The other factors were found statistically significant in all periods. In the three periods of live weight investigated, genotype's effect being high in general variation as 25.03% ($P < 0.001$), 9.29% ($P < 0.001$) and 16.70% ($P < 0.001$), respectively, shows that Turkish Merino lambs grow better and faster.

In this study, sex and birth type being found effective on growth, shows similarity with Özcan's (14), Readi's (16) and Oğan's (12) results but this study also shows contrary results with these studies indicating ewe's age effective on these traits.

Mature live weight of ewes:

Live weights before mating of Kıvırcık and Turkish Merino ewes, statistical analysis of the differences between the subgroups formed by the effects investigated of genotype and age and the effect ratios of these factors on live weight are presented in Table 4.

Live weights before mating of Kıvırcık and Turkish Merino ewes were determined to be 52.93 kg and 65.41 kg, respectively. Lowest live weights in both breeds were for two years old ewes and highest live weights were for five years old ones of Kıvırcık ewes and for four years old ones of Turkish Merino ewes. Differences among the general values of genotypes were found statistically significant ($P < 0.05$).

Table 4. Live weights of Kıvırcık and Turkish Merino ewes and effect ratios (ER) of genotype and age on live weight.

Factors		Kıvırcık			Turkish Merino			General	
		n	$\bar{x}$	$s_{\bar{x}}$	*n*	$\bar{x}$	$s_{\bar{x}}$	*n*	*ER*
Genotype	Kıvırcık	87	52.93^{b}	0.818				87	-7.088^{b}
	T.Merino				90	65.41^{a}	0.626	90	7.088^{a}
Age	2	9	41.44^{c}	0.669	20	60.60^{b}	1.143	29	-7.229^{c}
	3	7	51.14^{b}	1.699	24	64.13^{ab}	0.666	31	-1.889^{b}
	4	38	53.84^{ab}	1.012	16	68.69^{a}	1.145	54	1.933^{a}
	5	10	57.90^{a}	2.964	15	68.27^{a}	1.503	25	3.507^{a}
	6	13	54.08^{ab}	1.521	7	67.00^{a}	3.273	20	-1.531^{a}
	7	10	54.60^{ab}	2.754	8	68.00^{a}	2.228	18	2.147^{a}
μ								177	59.196

^{a,b,c} : In each of the subgroups, means followed by different superscripts differ significantly ($P < 0.05$).

In this study, live weights of Kıvırcık ewes were found higher than the results reported by Sönmez et al. (21), Altınel et al. (2), Başpınar (3) and Özcan's (14) and live weight of Turkish Merino ewes were higher than the results indicated by İmeryüz (11), Schmidt (17) and Oğan (12).

Expected average for live weight was determined as 59.196 kg. Kıvırcık ewes were 7.088 kg lower and Turkish Merino ewes were 7.088 kg higher than this average. The difference between the breeds as 14.76 kg was found statistically significant ($P < 0.001$).

As factors, genotype and age was found highly effective ($P < 0.001$) on live weight. From the determination degrees (60.07%) of these two factors on live weight, genotype had a higher ratio (50.64%). These results showed Turkish Merino ewes' superiority on Kıvırcık

ewes and the live weights being higher than the other flocks investigated in other studies, indicated that management condition of this flock is exceptional in Turkey.

Conclusion

In the first upgrading studies to Merino the aim was to provide the production of thin wool need of Turkey. Especially wool needed for knitted work industry is only produced by Merino Sheep Breed. Today, some of the thin wool need of Turkey is produced by Turkish Merino Sheep. One of the breeds used to produce crossbreed Turkish Merino Breed is indigenous Kıvırcık Sheep Breed. As Kıvırcık and Turkish Merino Breeds' wool types are much different, wool type traits are not included in this study. But in recent years in Turkey, whatever the breed's production type is, economically, meat production takes the most important place. For meat production, reproductive performance, survival and growth rates of the flock has great importance. This study, in which Kıvırcık Sheep and Turkish Merino Sheep which was originated from indigenous Kıvırcık sheep, were managed together in the same flock, showed that Turkish Merino Sheep Breed has developed important superiority to indigenous Kıvırcık Sheep Breed and it can be declared that the crossbreeding study has reached its aim to achieve an improved breed for production traits in Turkey. Moreover, most of the average results from all the sheep in the flock being superior to the one's given in the references indicate that the management and nutrition programs of this flock are chosen and being carried out in the right way and effectively.

References

1. **Akçapınar, H. (1974):** *Ile de France x Türk Merinosu Melezlemesi ile Kaliteli Kesim Kuzuları Elde Etme İmkanları.* Lalahan Zootekni Araştırma Enstitüsü Yayınları, No: 37, Ankara.

2. **Altınel, A., Evrim, M., Deligözoğlu, F., Özcan, M. ve Güneş, H. (1994):** *Kıvırcık, Sakız ve Alman Siyah Başlı koyun ırkları arasında yapılacak melezleme yoluyla döl ve et verim özelliklerinin geliştirilmesi: 1. Kıvırcık koyunlarda döl verimi, Sakız x Kıvırcık (Fı) kuzularda yaşama gücü ve büyüme özellikleri.* Hayvancılık Araştırma Dergisi, 4 (1): 29-33.

3. **Başpınar, H. (1985):** *Türkiye'deki başlıca koyun ırklarının yarı-entansif koşullardaki döl, süt ve yapağı verim performansları üzerinde mukayeseli bir araştırma.* İstanbul Üniversitesi Veteriner Fakültesi Dergisi, 11 (2): 43-66.

4. **DİE (1995):** *Tarım İstatistikleri Özeti 1993.* Devlet İstatistik Enstitüsü, No: 1720, Ankara.

5. **Duncan, D.B. (1955):** *Multiple range and multiple F-tests.* Biometrics, 11 : 1-42.

6. **Evrim, M., Demir, H. ve Başpınar, H. (1992):** *Kıvırcık koyun ırkının yarı-entansif koşullardaki verim performansı. I. Kuzularda büyüme ve yaşama gücü* İstanbul Üniversitesi Veteriner Fakültesi Dergisi, 17 (2): 1-12.

7. **FAO (1993):** *FAO Yearbook, Production 1992.* Food and Agriculture Organization of the United Nations, Statistics Series, No: 112, Rome.

8. **Goodnight, J.H. and Harvey, W.R. (1978):** *Least-squares means in the fixed effects general linear model.* SAS Technical Report (R-103), SAS Institute Incorporated, Cary, North Carolina.

9. **Goodnight, J.H. and Speed, F.M. (1978):** *Computing expected mean squares.* SAS Technical Report (R-102), SAS Institute Incorporated, Cary, North Carolina.

10. **Harvey, W. R. (1975):** *Least-Squares Analysis of Data With Unequal Subclass Numbers.* US Department of Agriculture, Report of Agricultural Research Service, H-4.

11. **İmeryüz, F. (1979):** *Texel ve Türk Merinosu Koyunlarının Önemli Verim Özellikleri Bakımından Kombinasyon İmkanları Üzerinde Araştırmalar.* Lalahan Zootekni Araştırma Enstitüsü Yayınları, No: 60, Ankara.

12. **Oğan, M. M. (1988):** *Türk Merinosu Koyunlarının Büyüme, Döl Ve Yapağı Verim Özelliklerine Bazı Çevre Faktörlerinin Etkisi ve Bu Özelliklere Ait Parametrelerin Tayini Üzerine Bir Araştırma.* İstanbul Üniversitesi Sağlık Bilimleri Enstitüsü Zootekni Anabilim Dalı Doktora Tezi.

13. **Örkiz, M. (1975):** *Karacabey ve Konya Merinosu koyunlarının Orta Anadolu şartlarında adaptasyon durumları.* Lalahan Zootekni Araştırma Enstitüsü Dergisi, 15 (3-4): 56-72.

14. **Özcan, H. (1975):** *Kıvırcık Koyunlarının Önemli Verim Özelliklerinin Geliştirilmesinde Texel Irkından Faydalanma İmkanları.* VHAG - 51 K Araştırma Projesi Kesin Raporu, TÜBİTAK, Ankara.

15. **Özcan, H. ve Akı, T. (1974):** *İnanlı Zootekni Araştırma Kurumunda Kıvırcık ve çeşitli Texel melez kuzuların gelişme ve yaşama gücü bakımından mukayesesi.* Lalahan Zootekni Araştırma Enstitüsü Dergisi, 14 (1-2): 3-21.

16. **Readi, C. G. A. (1984):** *Effect of some environmental factors on growth characters in German Mutton Merino lambs.* Avances en Producción Animal, 9 (1-2), 200. [Animal Breeding Abstracts 1986, 54 (7): 4441]

17. **Schmidt, L. (1960):** *Kreuzungsversuche mit Merinolandschafen und Ile de France.* Bayerisches Landwirtschaftliches Jahrbuch, Jahrgang 37 (5): 515-541.

18. **Searle, S.R. (1971):** *Linear Models.* Wiley & Sons, New York.

19. **Searle, S.R., Speed, F.M., Milliken, G.A. (1980):** *Populations marginal means in the linear model: An alternative to least squares means.* The American Statistician, 34: 216-221.

20. **Snedecor, G. W. and Cochran, W. G. (1980):** *Statistical Methods.* (7th Edition) Iowa State University Press, Ames, Iowa.

21. **Sönmez, R., Alpbaz, A. ve Kızılay, E. (1976):** *Doğu Frizya x Kıvırcık Melezlerinde Verim Özellikleri Üzerinde Bir Araştırma.* Ege Üniversitesi Ziraat Fakültesi Yayınları, No: 285, İzmir.

22. **Sönmez, R. ve Kızılay, E. (1972):** *E.Ü. Ziraat Fakültesi Menemen Uygulama Çiftliğinde Yetiştirilen İvesi, Kıvırcık, Sakız ve Ödemiş koyunlarının verimle ilgili özellikleri üzerinde mukayeseli bir araştırma.* Ege Üniversitesi Ziraat Fakültesi Dergisi, 9 (1): 3-51.

23. **Sönmez, R., Türkmut, L. ve Kaymakçı, M. (1991):** *Tahirova koyunlarında tipin sabitleştirilmesi ve halk elindeki Kıvırcık koyunlarının bu tiple ıslahı olanakları.* TÜBİTAK, Doğa Türk Veterinerlik ve Hayvancılık Dergisi, 15 : 72-86.

24. **Sönmez, R. ve Wassmuth, R. (1964):** *Untersuchungen über die Möglichkeiten der züchterischen Verbesserung der Milchleistung von Awassi (İvesi), Sakız (Chios) und Kıvırcık Schafen in der Türkei.* Züchtungskunde, 36 (1): 23-30.

25. **Welsch, R.E. (1977):** *Stepwise multiple comparison procedures.* Journal of the American Statistical Association, 72: 359.

26. **Yalçın, B. C. (1986):** *Sheep and Goats in Turkey.* Food and Agriculture Organization of the United Nations, Animal Production and Health Paper, No:60, Rome.