

## SELECTION OF KARAKUL LAMBS AFTER THE LENGTH OF PILOUS FIBERS

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### Abstract

*The purpose of this research was to elucidate the particularities of the correlative links of the length of the pilous fibers of the Moldavian Karakul lambs with their other morpho-productive characters. The length of the pilous fiber at Karakul lambs was defined as the absolute distance between the surface of the skin and the peak of the stretched fiber. This length was determined by the practical method during the evaluation under farm conditions, according to the Instructions of Karakul Sheep Evaluation. The method provides the determining the relative length of the fibers (the average length of a fiber tuft, mainly consist of thick and less of intermediate fibers) to the live lamb. The method of measurement consists in applying perpendicularly to the skin a millimeter ruler, with the sharp end in the seam of the curls, and with the tweezers the fiber tuft is stretched on the ruler graduation, fixing the indices at the peak of the fibers with the precision of 1mm. The scientific researches have demonstrated that the length of the pilous fibers in lambs of Moldavian Karakul is an important morpho-productive character, which has a significant impact on furskins quality. The optimal length of pilous fibers at lambs of superior elite class is within 7-12 mm. At lambs with valuable curling types (jacket, coastal, flat), the length of the fibers is shorter (9,80-11,53 mm), which is beneficial to the quality of the fur skin. The coastal and flat type of furskins have the shortest fibers (9.80-10.52 mm) compared to the jacket and kaukasian type (11.53-14.46 mm). Positive correlations between fiber length and mass and body length have been identified, and negative correlations with their length and modeling, which disadvantage the process of selecting of corpulent lambs - in the first case, and favor the process of selecting lambs with a valuable curling - in the second case. These correlations have been taken into account in the lambs selection. In the heterogeneous pairing of black and grayish parents, fellow descendants are obtained the grayish descendants with the shorter by 11.7% ( $P < 0.1$ ) of black fiber were obtained, thus with the more valuable furskin qualities, compared to the homogeneous pairing of both grayish partners. Pairing of sheep, with the jacket curling type, with rams, with coastal curling type, contributes to shortening of the length of the fibers at the descendants by 10.4% ( $P < 0.1$ ), thus improving the qualities of the furskin, compared to the mating of parents with jacket curling.*

**Key words:** length, fibers, furskins, lambs, Moldavian Karakul.

### INTRODUCTION

Pilous fibers of Karakul lambs have attracted the attention of several researchers and specialists in the field, since their arrangement on the surface of the furskin forms the curls of different types and sizes, which as a whole form the curling, determining its ornamental beauty (quality) (Иванов М.Ф., 1964; Дьячков И.Н., 1980; Гигинейшвили Н.С., 1976; Шеффер Х., 1977; Нел Дж.А., 1975; Матеп Х.Э., 1975).

Multiple researchers, independently of each other, have demonstrated that fiber length is a very important selection feature, which greatly influences the quality of curling and the value of the furskin as a whole (Бердалиева А.М. и др., 2015; Ержепов С., 2016; Прманшаев М. и др., 2016; Лаханова К.М., 2014). At the

Karakul lambs, this character correlates with a series of properties of the furskins, knowledge of which would allow to conduct the selection process in the desired direction.

According to Zahariov M.D. (1987), the length of the fibers depends, firstly, on the duration of the intrauterine period of development of fetus and on the specification of the furskin. Regardless of the color of the pilous cover, at the furskins obtained from the fetuses in the early stages of intrauterine development, the fibers are much shorter and in the late stages - much longer. The shortest fibers are Golyak type (1.89 mm). The Karakulcea and Karakul-Karakulcea furskins have an intermediate length of fibres, between the Golyak and Karakul furskins. Until birth, the daily increase in fiber length is on average about  $0.25 \pm 0.08$  mm. If to consider that the length of the black

fibers in the Karakul furskins is 100%, then their length in Karakul-Karakulcea is 27.3 - 47.9%, in Karakulcea it is 20.3 - 30.4%, in Golyak – 15.8 - 18.4%, and in Yahobab - 170-186%. The length of the fibers is related to the furskin assortment, with the type and shape of the curls, with their color. The shortest fibers had the sorts of furskins "Moscow Jacket", "Thin Coastal I", "Thin Flat I" and "Jacket I". At black furskins of these sorts, the average length of thick fibers is: 9.3; 9.3 to 9.9; 9.8 and 10.9 mm, respectively. At greyish furskins of these sorts, the length of thick black fibers is on average: 7.4; 9.1 to 10.0; 9.2 and 9.5 mm, respectively, at the gray-colored furskins, the length of thick fibers is on average 9.7; 9.8 to 10.1; 10.1 and 11.2 mm, respectively. The longest fibers are mentioned at furskins "Jacket thick", "Coastal thick I", "Thick flate I", "Kaukasian thick I" and lower sorts (II, III, defect). Thus, the average length of thick black fibers in these sorts was: 13.6; 13.2; 13.3 and 17.3 mm respectively. The length of the thick black fibers of grayish furskins of these sorts is 11.7; 13.2 to 15.1; 12.8 and 17.2 mm, respectively. At the grey furskins of these sorts, the length of the thick fibers is: 14,1; 13.7 to 18.2; 14.3 and 18.3 mm, respectively. The shortest fibers have the valuable curls: the tubular, coastal and flattened waves, at the ridges - narrow furrows, at moire curling. The longest fibers were observed at the worthless or defective curls (rings, half-rings, peas, corkscrew, snail). The black and gray furskins have shorter fibers than grayish pink and white furskins. The fluff type fibers, in all sorts and specifications of furskins, are always on 3-4 times shorter than rough and intermediate fibers.

The length of the fibers is hereditary conditioned and influenced by environmental conditions, especially by the ewes nutrition during the gestation period. A number of researchers (Аверьянов И. Я., Ибрагимов И. М., 1968, Дьячков И. Н., 1980, Кошевой М. А., 1975) demonstrated that poor nutrition conditions of pregnant sheep leads to the obtaining of lambs with shorter fibres and as a result with more valuable furskin qualities. At the same time, the Austrian professor Adametz L. (1911), many years ago, as a result of his research concluded that: „*The poor diet of*

*pregnant Karakul sheep not only affects the quality of buckling at lambs, as someone thought, but on the contrary, such nutrition proves to be quite unfavorable, because in these cases the furskins gets bad quality*”.

Another part of the researchers (Ескара М.А., 2014; Дюсегалиев М.Ж., 2010; Алибаев Н.Н. и др., 2014; Надвитов Н.К. et al., 2012) demonstrates that the qualities of hair fibers (including their length) in Karakul lambs have some particularities, depending on their belonging to the intra-racial types of sheep, created in different geographical areas, which also have some morpho-biological differences, obtained as a result of the specific selection, in addition to the pedoclimatic conditions of the respective areas. Therefore, in some types of newly created Karakul sheep, the relationship between fibers length and other morpho-productive selection characters can be distinguished, having specific configurations to those generally known.

In this context, the revealing of the particularities of the correlative links between the length of the hair fibers of the Moldavian Karakul lambs with their other morpho-productive features, presents a current problem that would make the selection process more efficient in the direction of increasing the quality of the furskins.

The purpose of this research was to elucidate the particularities of the correlative links of the length of the pilous fibers of the Moldavian Karakul lambs with their other morpho-productive characters (types of curling, length of curls, modeling of curling, color of parents, type of parents' curling).

## MATERIALS AND METHODS

The researches were carried out on a batch of Moldavian Karakul lambs from sheep flock of former sovhoz "Kotovskii", Cainari district and later of the National Institute of Animal Husbandry and Veterinary Medicine from Maximovca village, Anenii Noi district. In our research, the *length* of the hair fiber at Karakul lambs was defined as the absolute distance between the surface of the skin and the peak of the stretched fiber. This length was determined by the *practical method* during the evaluation under farm conditions, according to the

Instructions of Karakul Sheep Evaluation with Amelioration Principles in the Republic of Moldova (Buzu I., Zelinschi N., Evtodienco Silvia, 1996). The method provides the determining the relative length of the fibers (the average length of a fiber tuft, mainly consist of thick and less of intermediate fibers) to the live lamb. The way of measurement consists in applying perpendicularly to the skin a *millimeter ruler*, with the sharp end in the seam of the curls, and with the tweezers the fiber tuft is stretched on the ruler graduation, fixing the indices at the peak of the fibers with the precision of *1mm*.

Usually, the length of the fibers is measured on the croup, being the most important region, where the fibers are the shortest of all body regions. To determine the uniformity of the length of the fibers on the body surface, the measurement is also carried out on the withers. The smaller the difference between these two dimensions, the more uniform the length of the fibers is considered.

According to the evaluation instructions in force, the fibers (by length) can be: short (6-9 mm), medium (9-13 mm), long (14-18mm) and very long (> 18mm). In the practice of

evaluation also *very short fibers of < 6 mm* are differentiated.

The Pearson linear correlation coefficient ( $r_{xy}$ ) between the length of the fibers, on the one hand, and the mass and corporal length of the lambs, on the other hand, was calculated using the computerized software "STATISTICA-12". The data obtained as a result of the researches were statistically processed, and their certainty assessed according to the variational biometric statistics after the methods of Плохинский Н.А (1989).

## RESULTS AND DISCUSSIONS

The results of our research (Buzu I., 2012; Богданович Н.И., Бузу И.А., 1982а, 1982б; Buzu I., 1997) have shown that the length of pilous fibers at Moldavian Karakul lamb has, indeed, specific morphological particularities formed both under the influence of pedo-climatic conditions, in which this new type of sheep was created, and under the pressure of the selection process applied to its creation.

We have found that the length of lamb's fibers of Moldavian Karakul is significantly higher than that of lambs from Central Asia, researched by a number of authors (Table 1).

Table 1. The length of the fibers at black Karakul lambs of various types of curling

Length of fibers (mm) at lambs with type of curling:				The author of the source
jacket	coastal	flat	kaukasian	
11.53 ± 0.16	9.80 ± 0.19	10.52 ± 0.23	14.46 ± 0.20	Vuzu I. A. (1997)
7.50 ± 0.05***	6.70 ± 0.08***	6.70 ± 0.09***	10.20 ± 0.11***	Дьячков И.Н. (1963)
10.20 ± 0.07***	7.80 ± 0.09***	8.50 ± 0.08***	14.7 ± 0.12	Бадалбаев Н.С. (1966)
9.30 ± 0.04***	8.30 ± 0.12***	8.40 ± 0.06***	13.40 ± 0.10***	Кошевой М.А. (1975)
10.14 ± 0.06***	9.11 ± 0.11**	9.39 ± 0.09***	14.59 ± 0.13	Исаянц Б.Л. (1971)

Remark: \*\* P<0.01; \*\*\* P<0.001, compared to our data.

This difference in fiber length was observed at lambs with all types of curling, except Asian lambs of kaukasian type, investigated by Исаянц Б.Л. (1971), where the difference in fiber length practically is not found.

From the presented data it can be noticed, that the length of the lambs fibers at Moldavian Karakul lambs is obviously in relationship with the type of curling. It has been found that at lambs with valuable curling type, the length of hair fibers is shorter and lambs with worthless curling type (kukasian) have longer fibers. Lambs with coastal and flat curling type

possess the shortest fiber. Lambs with the kaukasian type of curling have the longest fibers. Lambs with the jacket type of curling usually have the medium length of the fibers. In continuation, we find that the length of the fibers correlates with other fur skin features such as: curl length, modelling, luster, silky, etc. The shorter the fibers, the longer the curls are. With the increase of the fibers length, the curls length become shorter, the modeling, the luster and the silky are diminished. The short and medium length of the fibers usually coincide with excellent modeling, good

pigmentation, high luster and silky. In the end result, the length of the fibers is correlated with the commercial qualities (features) of the furskins. At the furskins of sort I, the length of the fibers correlates positively with the surface of the furskin, its mass, the thickness of the dermis, fiber thickness, curl size and length. At the same time, the fiber length is in negative correlation with fiber density, shape and type of curls, curls length, curling uniformity and curls modeling. Our research has shown that the length of the fibers is corelates linearly positive with the lamb's body mass ( $r_{xy} = 0.22 \pm 0.09 - 0.31 \pm 0.09$ ) and body length ( $r_{xy} =$

$0.15 \pm 0.07 - 0.16 \pm 0.07$ ). This means that lamb selection in the direction of decreasing fiber length can lead to lower body development parameters.

We took this unfavorable relationship into account when the individual lamb selection was performed. For breeding, only individuals with well combination of short fibers and high body mass were selected.

We found that between the length of the fibers and the length of the curls at the Moldavian Karakul lambs there is an obvious negative phenotypical correlation (Tab. 2).

Table 2. The length of the pilous fibers depending on the length of the curls at Moldavian Karakul lambs

Length of curls	N	Length of fibers, mm		
		M ± m	σ	Cv %
Very long (> 50 mm)	48	8.58 ± 0.26***	1.80	21.0
Long (30 – 50 mm)	144	11.11 ± 0.19**	2.24	20.2
Medium (20 – 30 mm)	350	11.25 ± 0.13**	2.42	21.5
Short (12 – 20 mm)	76	12.21 ± 0.29	2.51	20.6
Very short (< 12 mm)	8	16.00 ± 0.54***	1.52	9.5

Remarc: \*\*- P<0.01; \*\*\*- P<0.001, – compared to the short length of the curls.

The results of the research have shown that the shortest pilous fibers ( $8.58 \pm 0.26$  mm) were recorded in lambs with very long curls. The longest fibers ( $16.00 \pm 0.54$  mm) were found in lambs with very short curls. With increasing of the curls length at the lambs, from short to very long, the length of the fibers decreased by 3.63 mm or 29.7% (P <0.001).

Thus, compared with the batch of lambs with short curls, the fiber length of the lambs with medium curls was smaller by 0.96 mm or 7.9% (P <0.01), at the lambs with long curls were shorter with 1.10 mm or 9.0% (P <0.001) and at lambs with very long curls - by 7.42 mm, or 46.4% (P <0.001).

Therefore, we can conclude that, with increasing of curls lengths, fibers become shorter, thus increasing the quality of modeling, luster and silk.

This phenotypically negative correlation, in fact, is favorable for amelioration the quality of the furskins in the herd.

Thus, choosing for breeding the lambs with short fibers, we have indirectly accumulated in the herd individuals with long and very long curls, desired to improve the quality of furskins in the sheep population. The length of the fibers correlates quite close to the modeling of the curling (Table 3).

Table 3. The length of the fibers depending on the modeling of the curling at Moldavian Karakul lambs

Curling modeling	N	Fibers length, mm		
		M ± m	σ	Cv %
Excellent	195	10.46 ± 0.16***	2.19	20.9
Appropriate	247	11.24 ± 0.18*	2.80	25.1
Weak	82	12.07 ± 0.31	2.80	23.2
Insufficient	9	12.78 ± 1.46	4.12	32.2

Remarc: \*- P<0.05; \*\*\*- P<0.001, compared to weak modeling.

We have found that lambs with excellent curling modeling possess the shortest fibers and those with insufficient curling modeling -

the longest hair fibers. With increasing of curling modeling, from insufficient to excellent, fiber length decreases from  $12.78 \pm$

1.46 mm to  $10.46 \pm 0.16$  mm or 18.2% ( $P < 0.001$ ). The lambs with excellent curling modeling have shorter lengths of pilous fibers compared to lambs with weak curling modeling with 1.61 mm or 13.3% ( $P < 0.001$ ) and compared to lambs with the appropriate modeling - by 0.78 mm or 7.0% ( $P < 0.001$ ). Therefore, the more valuable the modeling, the shorter the length of the fibers, and vice versa, the weaker the modeling, the longer is the length of the fibers. The length of the lamb's fibers also depends on the parent's mating variants by color. In case of the market requires grayish furskins, the breeders of Karakul sheep apply the heterogeneous mating after color of

the black ewes with grayish rams and homogeneously of both grayish partners, with the purpose obtaining of grayish descendens. In addition, by homogeneous mating of grayish sheep, the selectors aim to increase the rate of the furskins of desired colors (bluish, marbled, etc.) with excellent and appropriate uniformity, applying the ITV method of evaluation (early identification of viability).

In these situations, it is important to know the impact of different variants of sheep mating after color - homogeneous and heterogeneous, both on the length of the fibers and on the quality of the furskin curling as a whole (Table 4).

Table 4. The length of fibers at Moldavian Karakul lambs, obtained as a result of the homogeneous and heterogeneous pairing of the parents by color, mm

The color of the parents		N	Croup		Withers	
Ewe	Ram		M ± m	Cv,%	M ± m	Cv,%
Black lambs						
Black	Black	48	$9.79 \pm 0.38$	27.2	$14.44 \pm 0.45$	21.6
Black	Grayish	159	$10.36 \pm 0.28$	24.1	$14.81 \pm 0.25$	21.1
Grayish lambs, black fibers						
Black	Grayish	52	$10.98 \pm 0.37^*$	24.6	$15.23 \pm 0.49$	23.3
Grayish	Grayish	9	$12.44 \pm 0.80^{**}$	19.3	$15.66 \pm 1.05$	20.1
Grayish lambs, white fibers						
Black	Grayish	52	$14.77 \pm 0.49$	23.1	$20.54 \pm 0.54$	10.2
Grayish	Grayish	9	$14.12 \pm 1.16$	24.6	$20.78 \pm 1.22$	17.6

Remarc: \* -  $P < 0.05$ ; \*\* -  $P < 0.01$ , compared to homogeneous pairing „Black x Black”.

The results of the researches have shown that the shortest fibers both in the croup region ( $9.79 \pm 0.38$  mm) and in the withers ( $14.44 \pm 0.45$  mm) possess the lambs obtained by homogeneous mating of the black parents.

As a result of the heterogeneous pairing of black parents with grayish, compared to the homogeneous pairing of black partners, there is a tendency of fibers elongation in descendants of both black and grayish lambs. The longest black fibers on both the croup and the withers were recorded at the lambs obtained from the pairing of both grayish parents. Thus, the black fibers from the croup of grayish lambs, born from the heterogeneous mating of the parents, were longer compared to the lambs born from the homogeneous pairing of the black parents with 1.19 mm or 12.2% ( $t_d = 2,25$ ;  $P < 0.05$ ). And the black fibers of lambs born from the homogeneous mating of the grayish sheep were

longer compared to the same contemporaries by 2.65 mm or 27.1% ( $t_d = 3.01$ ;  $P < 0.01$ ). Therefore, we can say that the heterogeneous mating of black sheep with grayish, as well as homogeneous mating of grayish sheep, leads to elongation of the fibers in the progeny, with a possible negative impact on the qualities of curling as a whole. Knowledge of these aspects requires the disclosure of breeders with specific heredity genotype in the progeny of the length of the fibers to attenuate this impact by applying appropriate mating by color of the sheep.

The length of lamb's fibers in Moldavian Karakul is related to the type of parental curling (Table 5).

Research has shown that use of one of the partners with the coastal type of curling for mating allows, in a directed manner, to reduce fibers length in descendants. The shortest fibers

were recorded in the lambs obtained by "♀coastal x ♂jacket", "♀jacket x ♂coastal" and ♀kaukasian x ♂coastal mating. The longest fibers were found in the lambs obtained from the matings "♀jacket x ♂jacket" and "♀jacket x ♂flat".

Knowledge of the mode of transmission by heredity of fiber length in different sheep breeding variants in certain populations (flocks) allows the selection to be routed in the desired directions.

Table 5. The length of the fibers in Moldavian Karakul lambs according to the type of parents' curling, mm

Type of parents' curling		N	M ± m	
Ewe	Ram		Croup	Withers
Coastal	Jacket	46	10.1 ± 0.79*	14.0 ± 0.81
Kaukasian	Coastal	39	11.0 ± 0.80	14.9 ± 1.08
Kaukasian	Jacket	47	10.9 ± 0.62	15.1 ± 0.85
Jacket	Jacket	108	11.3 ± 0.24	14.5 ± 0.29
Jacket	Flat	55	11.3 ± 0.71	15.0 ± 1.53
Jacket	Coastal	66	10.5 ± 0.47*	14.1 ± 0.51

Remarc: \*- P=0.1 compared to mating type „Jachet x Jacket”.

The pairing of partners with certain fiber lengths, taking into account the specific character of transmission by heredity of this character, allows to increase the probability of obtaining the progeny with the desired length of the fibers.

Based on the results of these researches, concrete proposals for mating the sheep in a homogeneous and heterogeneous system were developed, according to the color of the pilous cover, taking into account the length of the fibers, especially of the rams at birth. Using the guided matings, taking into account the color of the pilous cover and the curling type of sheep, the annual increase of lambs of superior classes (elite and class I) in proportion of 3-5% in the selected flocks were established. The most valuable results were obtained when for the mating the rams with jacket and coastal curling were used, with short, excellent silknes and luster fibers. We have found that for lambs of certain classes and types of curling are characteristic a certain length of fiber. The length of the fibers has an intermediate heredity character, so, in descendants, the fiber length tends to the average of the parents. Generalizing the results of the research, we can conclude that the optimal length fibers at lambs of the superior and elite classes is within the limits of 7-12 mm. At lambs with the coastal curling type, the optimal length of the fibers is <10 mm, at those with the flat curling type it is 10 to 11 mm, and in the ones with the jacket type of curling is between 11-12 mm. In lambs

with the not valuable kaukasian curling type, the length of the fibers is the longest (13.0-15.0 mm). Therefore, the length of fibers at lambs with required curling types (jacket, coastal, flat) is shorter, which favors the formation of valuable curls.

On the basis of the results of these researches, the parameters of fiber differentiation according to length were developed, included in the Instructions of Karakul Sheep Evaluation with Amelioration Principles in the Republic of Moldova (1996); were elaborated efficient sheep mating procedures according to the color of the pilous cover and the type of parental curling, which were included in the Recommendations on the technology of the sheep products in the Republic of Moldova.

## CONCLUSIONS

The length of the pilous fibers in lambs of Moldavian Karakul is an important morpho-productive character, which has a significant impact on furskins quality.

The optimal length of pilous fibers at lambs of superior elite class is within 7-12 mm. At lambs with valuable curling types (jacket, coastal, flat), the length of the fibers is shorter (9,80-11,53 mm), which is beneficial to the quality of the furskin.

The coastal and flat type of furskins have the shortest fibers (9.80-10.52 mm) compared to the jacket and kaukasian type (11.53-14.46 mm).

Positive correlations between fiber length and mass and body length have been identified, and negative correlations with their length and modeling, which disadvantage the process of selecting of corpulent lambs - in the first case, and favor the process of selecting lambs with a valuable curling - in the second case. These correlations have been taken into account in the lambs selection.

In the heterogeneous pairing of black and grayish parents, the grayish descendants with the shorter length 11.7% ( $P < 0.1$ ) of black fiber were obtained, thus with the more valuable fur qualities, compared to the homogeneous pairing of both grayish partners.

Pairing of ewes, with the jacket curling type, with rams, with coastal curling type, contributes to shortening of the length of the fibers at the descendants by 10.4% ( $P < 0.1$ ), thus amelioration the qualities of the fur, compared to the mating of parents with jacket curling.

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