

# THE SIZE OF CURLS AT THE MOLDAVIAN KARAKUL SKIN

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## Abstract

The purpose of this paper was to assess the value of preference of the Karakul skin depending on the size curls and the correlative links revelation of this character (size curls) with other qualities of the skin. A special questionnaires study was been conducted in which 20 consumers - people of skins have been questioned, who were not professionals in skins Karakul quality assessment. Respondents assessed independently the degree modeling of curls on a batch of the black skins and a batch of the grayish skins of sorts with different size of curls. In both batches of the skins (black and grayish) were been exposed for questioning a skin for Kirpuk shorts with very small curls (<4 mm), a Moscovite Jackets skin with small curls (4-5 mm), a skin Jachet I with medium curls (6-8 mm), a Thick Jacket skin with large curls (9-12 mm) and a Thick Costal I skin with very large curls (> 12 mm). Assessment of the same skins was carried out at a distance of 3, 7 and 10 m from the questioned person until the skin. Each questioned have been appreciated the degree of curls modeling at the Karakul skins by giving preference points after decimal scale from 1 to 10 points. That was been found, in the experiment, that skin Karakul with medium curls (6-8 mm), large (9-12 mm) and very large (> 12 mm) had a higher preference value, compared with skins that has small and very small curls. With increasing viewing distance of skin from 3 m to 10 m their preference value decreases: at the black skin with medium, large and very large curls - with 7.0 to 16.9%, and those with small and very small curls - with 17.0 to 34.0%; at the gray skins with medium, large and very large curls - with 20.3 to 23.8%, and those with small and very small curls - with 24.4 to 26.3%. Given the amount of skin preference, widths (size) medium and large of curls have been considered the required character, and small and very small sizes have been considered undesirable characteristics. Despite the fact, that very large curls have been obtained in the questionnaires experiment a high preference value, this size category of curls is not recommended as requested, because the research has shown, that very large category of curls is in negative correlation with a series of the curls and the skin qualities as a whole. Based on the results of research carried out, have been elaborated a new scale of differentiate of curls after size in which the small curls, through the appreciation with low scores, are not considered required, and medium and large curls are considered required. The scale provides for differentiation of curls at the lambs Moldovan Karakul after size in: very small curls (< 4 mm), small (4-5 mm), medium (6-8 mm), large (9-12 mm) and very large (> 12 mm). For selection and reproduction in breeding batches to creating the type of sheep Moldavian Karakul have been recommended the lambs of upper classes with medium and large curls after width.

**Key words:** the preference value, the size of the curls, Karakul skins

## INTRODUCTION

The notion of curls size of Karakul lambs is meant its width (large), and the distance between the outermost points of the sides' lateral of the curls.

The first descriptions of the characteristics of curls at the Karakul lambs were performed

in the late century XIX - early century XX by researchers tsarist Russia (Тихомиров В.А. [32]; Петров Н.В. [28]; Силицын И.В. [30 31]; Иванаев И. [18]; Демянко В.Я. [14] Иванов М.Ф [19], who have taken over as based classification system of curls applied by Ukrainian sheep farmers at the breed lambs appreciation lambs from races for skins, such as Sokoliska and Resetilovka. Description of types and forms of curls was then performed in general, using the first notions of small

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curls, medium and large without applying concrete dimensions.

Subsequently, the science of shapes and dimensions of curls at the Karakul lambs was independently developed by academician ВАСХНИЛ Иванов М.Ф. [20-23] and professor Wien (Austria), L. Adametz [1-2]. Further, the methodology of assessment of curls and their classification system Karakul lambs was developed by Васин Б.Н. professor at the Institute for Fur skins Research from Moscow (9-11), and perfected by researchers Union Institute of Scientific Research for Karakulturies of Samarkand (Дьячков И.Н., Письменная Р.Т., [15-16] Кузнецов Б.А., [27]; Закиров М.Д. [17] Кошевой М.А. [26], who filled them with new concepts of shape and dimensions of curls, describing their specific assessment methodology.

As a result, in the former USSR were developed and officially approved Instructions of evaluation Karakul lambs improvement principles [24-25], according to which, curls were differentiated by size categories: small < 4 mm; medium 4 to 8 mm, and larger > 8 mm. Small and medium curls were considered requested but large curls were considered undesirable. For selection and reproduction were recommended lams with small and medium curls, and large curls lambs were not recommended for reproduction.

Analyzing multiple assessments and opinions of sheep farmers, traders and consumers of skins from Republic of Moldova have been observed that, they have a particular view on the size of Karakul lambs curls, characterized in, that prefers skin with large curls and does not prefer skin with small curls. This preference does not refer to the height of the curls, are preferred as skin with low curls, flattened or costal, with the smallest height. For skin with large curls, traders always paid a higher price than skin with small curls. For these reasons, the Karakul sheep farmers have reinforced their opinion that large loops lambs are most valuable and recommended for reproduction and lambs with small loops are not valued and eliminated from reproduction. Analyzing this situation we found that opinion Karakul sheep farmers and skin consumers from Republic of Moldova were contrary with

official Instructions of evaluation of Karakul lambs from that time.

In this context, the aim of this research was to assess the value of preference of Moldavian Karakul skins depending on the size of curls and revelation of correlative links of this character with other qualities of the skin.

## MATERIAL AND METHODS

In order to assess the value of preference of Moldavian Karakul skin depending on the size of curls we performed a special survey questionnaire of 20 consumers - people of skins have been questioned, who were not professionals in Karakul skins quality assessment. Respondents assessed independently the degree modeling of curls on a batch of the black skins and a batch of the grayish skins of sorts I with different size curls. In both batches of the skins (black and grayish) were been exposed for questioning a skin for Kirpuk shorts with very small curls (<4 mm), a Jackets moscovite skin with small curls (4-5 mm), a skin Jachet I with medium curls (6-8 mm), a Jacket thick skin with large curls (9-12 mm) and a Costal thick I skin with very large curls (> 12 mm). To be specific we bring characteristic of these sorts of skin, to meet current standards "*GOST 8748-70, undressed pure-bread black Karakul, specifications*" [12] and "*GOST 2865-68, undressed Grey persian lamb of pure breed, specifications*" [13]. Shorts of skin: Kirpuk - have often pilose coating, silky, shiny, thigh and loin are narrow tubes (small), mixed with ridge-furrow narrow, long and medium long, strong and elastic, passing sides in tubes short and narrow ridges, thin-skin is normal; Jackets Muscovite - have often pilose coating, silky, shiny, thigh and back are small tubes, after resistance and elasticity reduced width, long and medium long moving sideways with short tubes and bob, is allowed an insignificant quantity of ridges, the skin is thin; Jackets I - have often pilose coating, silky, shiny skin on the thigh and back are long tubular waves and medium long, passing on lateral sides in the long and short middle tubes, dense and resistance, of medium size. Is admitted an insignificant quantity of ridges, the skin is thin or thickened; Jackets thick - they have often

pilose coating, silky, shiny, the thigh and back are big tubes (large), dense and resistant, medium long and short, moving sideways with short tubes and bob, with an insignificant quantity of ridges, the skin is thick or thickened; Costal thick I - have often pilose coating, silky, shiny, on the back and costal, are costal waves and ridges, big (large), resistant, long, medium long and short, mixed with large tubes of different lengths, on the sideways are costal waves and big ridges, Middle long and short, mixed with wide bob, skin is thick.

Assessment of the same skins was carried out at a distance of 3, 7 and 10 m from the person questioned to the skin.

Each questioned appreciated the degree of modeling curls in Karakul skin by giving points after preference decimal scale from 1 to 10 points. Each questioned person was explained how to score granting preference as follows: when the questioned person consider that skin modelling is excellent, this

(person) gives from 8 to 10 points; when the skin modeling it seems, the person gives from 5 to 7 points; when modeling of the skin seems poor (low) is given 3 or 4 points, and, if the skin is insufficient modeling is given 1 or 2 points.

The data obtained in the experiences were processed statistically using computer software "STATISTICA-6" and appreciated their certainty, according to variation biometric statistic after methods of Плохинский Н.А. [29].

## RESULTS AND DISCUSSIONS

Research results demonstrated, that the preference value of Moldavian Karakul skin expressed in the score (1 to 10 points) reflects, in principle, the degree of clarity of modeling curls and is in directly related to the size of curls and viewing distance of the skin (Table 1).

Table 1 Preference value of Moldavian Karakul skin depending on the size of curls and viewing distance, points

Assortment name, size of curls	Distance 3 m		Distance 7 m		Distance 10 m	
	M ± m	rang	M ± m	rang	M ± m	rang
Black skin (N = 20)						
Kirpuk, very small (<4 mm)	7.20 ± 0.40	3	6.75 ± 0.50	4	4.75 ± 0.51	5
Jachet moscovite, small (4-5 mm)	6.15 ± 0.42	5	6.00 ± 0.53	5	5.10 ± 0.46	4
Jachet I, medium (6-8 mm)	7.40 ± 0.34	2	6.80 ± 0.42	3	6.15 ± 0.54	3
Jachet thick, large (9-12 mm)	7.10 ± 0.35	4	7.00 ± 0.45	2	6.60 ± 0.47	2
Costal thick I, very large (>12 mm)	7.90 ± 0.46	1	7.65 ± 0.52	1	6.70 ± 0.54	1
Grayish skin (N = 16)						
Kirpuk, very small (<4 mm)	6.44 ± 0.51	5	6.07 ± 0.49	5	4.87 ± 0.59	5
Jachet moscovite, small (4-5 mm)	6.44 ± 0.53	4	6.33 ± 0.53	4	4.75 ± 0.59	4
Jachet I, medium (6-8 mm)	7.87 ± 0.31	2	7.47 ± 0.47	3	6.00 ± 0.67	3
Jachet thick, large (9-12 mm)	7.69 ± 0.31	3	7.60 ± 0.44	2	6.13 ± 0.65	2
Costal thick I, very large (>12 mm)	8.56 ± 0.36	1	7.73 ± 0.43	1	6.75 ± 0.60	1

We found that both colors of skin, preference the highest value at all viewing distances, had a skin from shorts Costal thick I, with very large and very long curls, that extend to the surface of the skin, modeling shaped parallel-scale called by amateur breeders of sheep "whip". These skins were occupied, among others, permanent rank 1 after preference value. Among the black skin, the lowest preference value had Jacket moscovite skin shorts with small curls, who occupied, usually, the rank or second rank in the string of skins included in the experiment.

We also, observed that viewing black skin from a distance of 3 m, at the other sorts of skins does not exists a clear ranking relationship between preference values and curls size. Thus, Kirpuk skin shorts, with very small curls, were placed after value preference in rank 3, after Jackets I skin shorts with curls medium. This is explained by the fact that the skin of this short with very small curls at viewing from small distances has a good clarity of the modeling and aesthetic appearance quite beautiful and attractive.

At the grayish skin, viewed at a distance of 3 m, there is a more clear relationship between the preference value and size of curls. From the ranks of forehead belong Costal thick I shorts with large curls, Jackets I shorts with medium curls and Jacket thick with large curls. Jacket moscovite skin shorts with small curls and those of Kirpuk shorts with very small curls are part of the lower ranks, occupying the last and second last place.

At a distance of 7 m of view, the relationship between the preference value and size of curls both at black skin and the grayish gets more closely. On the first and second rank by preference value were placed shorts from Costal I skin with very large curls and Jacket thick with large curls. In the third rank were placed the skin shorts Jacket I with medium curls size, and the last two ranks were placed leather shorts with the Kirpuk skin shorts with very small curls and Jacket moscovite with small curls.

The viewing distance of 10 m, the relationship between preference value of skin and curls size is accentuated and rather obvious. With the increasing curls size from very small to medium, high and very high, at the black skin increase their preference value from  $4.75 \pm 0.51$  points, to  $6.15 \pm 0.54$ ;  $6.60 \pm 0.47$  or  $6.70 \pm 0.54$  points, or 29.5; 38.9 and 41.1% ( $t_d = 2.0$  and  $2.7$ ,  $P < 0.05$  and  $P < 0.01$ ). And vice versa with decreasing size of the curls at the skin, preference decreases their preference value.

More obvious, the preference value of Moldavian Karakul skin depending on the size of curls can be visualized in diagrams 1 and 2. From the diagrams it is clear, that skin both black and grayish with medium curls, large and very large, at all viewing distances, have greater preference value, compared to skin with small and very small curls. The configuration of diagrams from both figures is quite similar.

At the same time, we found that, with increasing viewing distance of skin from 3 m to 10 m, their preference value decreases to all sorts, regardless of the curls size, but rhythm of decrease and the gap preference value at the skin is different. The most decrease of preference value was recorded at skin with small and very small curls, by touching 17.1 and 34.0% at the black skin, and 24.4 and 26.3% at the grayish skin. While, at the skin with large and very large curls the decreasing of preference value was more moderate, constituted 7.0 and 15.3% at black skin and 20.3 and 21.1% at grayish skin.

However, with increasing viewing distance can observe an increase of the gap between the preference value of skin preference with large and very large curls, as compared with those with small and very small curls. This relationship is reflected in preference value ratios of skin depending on the curls size and a viewing distance (Table 2).

We found that, with increased viewing distance of skin from 3.0 to 10 m, increase and the difference between the preference value of skin with large and very large curls as compared to those with low and very low curls. Thus, if at the distance of 3 m, black skin with very large curls exceeded by the preference value the skins with very small curls with 9.7%, then at the distance of 7m these exceeded already with 13.3%, and at distance of 10 m - with 41.1%. A separated case is observed in the ratio of preference value of the skin with large curls, as compared to those with very small curls. This (the report) is negative at a viewing distance of 3 m (-1.3%), becomes positive at a distance of 7 m and significantly increases at the distance of 10 m to 38,9%. Also, the ratio between preference values of skin with large curls, as compared to those with small curls increased from 115.4% at the distance of 3m, to 129.4% of the viewing distance of 10 m.

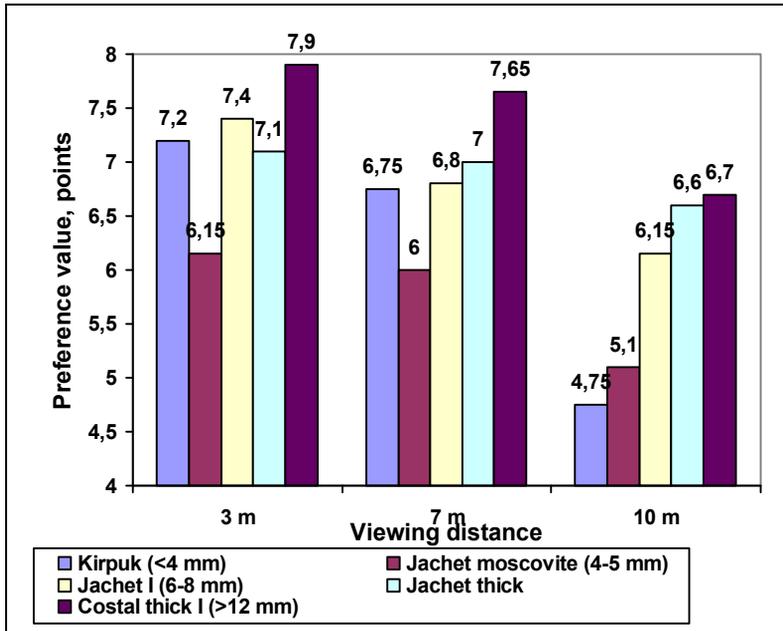


Fig. 1 The preference value of black skin

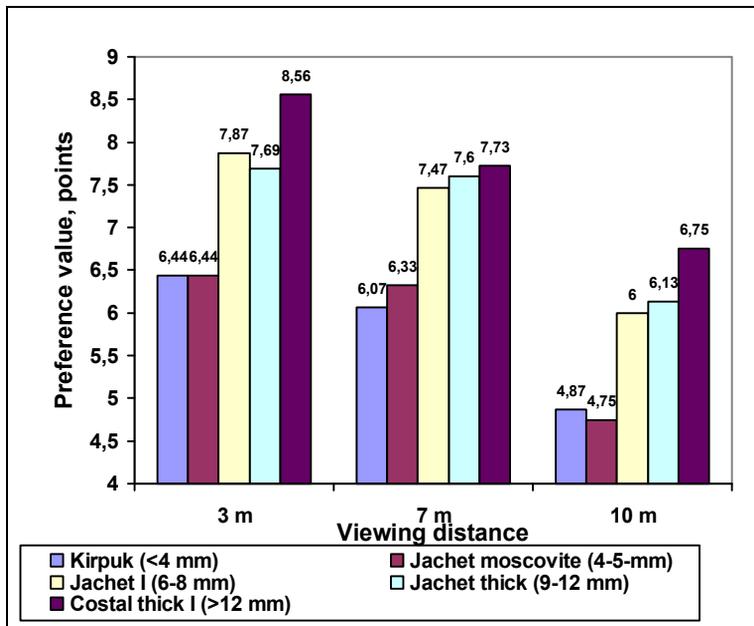


Fig. 2 The preference value of grayish skin

Table 2 Dynamics of rations of skin preference value depending on the curls size and viewing distance, %

Specify of ration of skin preference value	Viewing Distance		
	3 m	7 m	10 m
At the black skin			
Skin with very large curls / skin with very small curls	109.7	113.3	141.1
Skin with large curls / skin with very small curls	98.6	103.7	138.9
Skin with medium curls / skin with very small curls	102.8	100.7	129.5
Skin with very large curls / skin with small curls	128.5	127.5	131.4
Skin with large curls / skin with small curls	115.4	116.7	129.4
Skin with medium curls / skin with small curls	120.3	113.3	120.6
At the grayish skin			
Skin with very large curls / skin with very small curls	132.9	115.4	138.6
Skin with large curls / skin with very small curls	119.4	113.4	125.9
Skin with medium curls / skin with very small curls	122.2	123.9	118.1
Skin with very large curls / skin with small curls	132.9	122.1	142.1
Skin with large curls / skin with small curls	119.4	120.1	129.0
Skin with medium curls / skin with small curls	122.2	118.0	121.1

A similar situation denotes at the grayish skin. So, the difference between the preference value of the skin with the large loops and those with smaller curls is amplified from 19.4% at a distance of 3 m to 29.0% at a distance of 10 m, between the skin with large curls and very small curls increases from 19.4% at a distance of 3 m, to 25.9% at the distance of 10 m. More accentuated preference the gap increases between the values of the skin with large curls, very large and, those with small curls, very small at the viewing distances from 7 to 10 m. Thus, the ratio of preference value between the skin with very large curls and those with very small curls very increase from 115.4% at the distance of 7 m to 138.6% at the distance of 10 m.

Between the skin with large curls between the skin and those with very small curls the ratio increased from 113.4% at the distance of 7 m to 125.9% at the distance of 10 m.

Therefore, generalizing dynamics date analysis of preference value of skin depending on the curls size and their viewing distance can be concluded that, skin with large and very large curls, and those with medium curls are more preferred for consumers' skins, as compared with skins with small and very small curls.

With increased viewing distance, preference value of skins with small and very small curls decreases significantly, as compared to that of skin with medium, large and very large curls. The skin with medium, large and very large

curls have greater preference value and keep this value at higher viewing distances. This preference is explained, after us, in that it larger curls more expressive on the skin, better reflects the rays of light, giving a clear and valuable modeling of curls. The large curls are more evident visually observed from a greater distance, whereas the small curls on the contrary, at distances exceeding 3m are not discerned, not sufficiently reflect light rays, therefore, the curls gets melded and opaque appearance, losing the clarity of modeling and, as a result, the preference value. Due to these considerations, skin with large curls are more required for sheep breeders and skin consumers.

Our conclusions are in partial concordance with views of Th. Nicov [6], which affirm that "large curls give it a better lustier than small curls".

Based on the research results we have developed a new scale of curls differentiation by size, when the small curls, through low scores appreciation, does not considered requested, but large curls are considered required. The scale provides a differentiation of curls at the Moldavian Karakul lambs according the size: very small curls (<4 mm), small (4-5 mm), medium (6-8 mm), large (9-12 mm) and very large (> 12 mm). This scale was included in the new Instructions of evaluation Karakul sheep with improvement principles in the Republic of Moldova [3], approved by the Ovi culture of Council Department of Animal Husbandry of Ministry of Agriculture and Food.

Comparing this classification scale of curls after size with the parameters set in other countries from farming areas of sheep from races Karakul breed we find that parameters

we have been developed partly resembles in some limits, but also differ more or less from them by specific dimensions (Table 3).

Table 3 Classification of curls after size (width) in different countries

Source of information		The length of the curls, mm				
		Very small	small	medium	large	Very large
Instruction of evaluation, Republic of Moldova [3]		< 4	4 – 5	6 – 8	9 – 12	> 12
Instruction of evaluation, former USSR [24, 25]		-	< 4	4 – 8	> 8	-
Guidance, Romania, Pascal C. [7]	black skin	-	< 4.5	4.5 - 10	> 10	-
	grayish skin	-	< 5	5 – 14	> 14	-
Guidance, Romania, Taftă V. [8]	black skin	-	< 4.5	4.5 – 8	8 – 12	> 12
	grayish skin	-	< 5	5 - 10	10 - 14	> 14
Guidance, Austria, Adametz L. [2]		-	2 - 4	5 - 10	10 - 15	-

The data presented table we found that, dimensions of differentiation of curls by size, to some extent, in part, similar to parameters set out in the technical guidance of Romania [7, 8] and Austria [2] for medium and large curls, and in less as with the instructions of evaluation parameters set in the former USSR Karakul lambs. However, the size of curls established by us differ from those in the above technical guidance by wider classification of curls size in very small and very large categories, and also, more precise differentiation of categories of small curls,

medium and large. Despite the fact that were large curls obtained in the questionnaires experiment a preference value high enough, this category of curls size does not recommended as requested because previous research [4, 5] they showed that very large category of curls is in negative correlation with a number of qualities of curls and the skin in general.

We found that, the size of the curls is in relatively strong relationship with curls type of Karakul lambs skin (Table 4).

Table 4 Type of curls at the Moldavian Karakul lambs depending on the size of the curls

Size of the curls	N	Including							
		Jachet		Costal		Flat		Kaukazian and brac (low quality)	
		cap	%	cap	%	cap	%	cap	%
Very large (>12 mm)	20	3	15	-	-	6	30	11	55.0
Large (9-12 mm)	136	27	19.9	49	36.0	46	33.8	14	10.3
Medium (6-8 mm)	381	168	44.1	112	29.4	53	13.9	48	12.6
Small (4-5 mm)	88	15	17.1	17	19.3	-	-	56	63.6
Very small (< 4 mm)	10	-	-	-	-	-	-	10	100
Total	635	213	33.6	178	28.0	105	16.5	139	21.9

Data analysis shows that, lambs with medium and large curls posses the best types of curls. In the bench of lambs with large curls predominates mostly, individuals with desired curls types: costal (36.0%), flat (35.8%) and jacket (19.9%). In the lambs bench with medium curls prevails individuals, also, with requested types: jacket (44.1%), cost (29.4%) and flat (13.9%).

However, in these batches was registered the lowest frequency of lambs with curls

undesirable types kaukazian and brac. Lambs with curls small, very small and very large type have weak type of curls, unwanted, in more part, the kaukazian type and brac, constitutes respectively 63.6; 100 and 55.0%. Typically, the large curls met in the coastal waves, flat, at the furrows and ridges-furrows sometimes at the hollow waves and bob. The medium curls were more frequent at the skin with tubular waves and bob. Very large curls were characteristic for some flat waves,

scattered ridges, rings, half-rings and bob. Small curls often met at the pea type and sometimes at the small tubes. Very small width was characteristic curls pea type and corkscrew at the lower sorts of skins.

Research results have shown, that size of curls influencing final quite evident and pronounced the classification on the whole of lamb (Table 5).

Table 5 Classification of Moldavian Karakul lambs depending on the curls size

The size of the curls	N	Including classe							
		elite		class I		class II		brac	
		head	%	head	%	head	%	head	%
Very large (>12 mm)	20	-	-	3	15	14	70	3	15
Large (9-12 mm)	136	60	44.1	59	43.4	17	12.5	-	-
Medium (6-8 mm)	381	96	25.2	234	61.4	51	13.4	-	-
Small (4-5 mm)	88	4	4.6	23	26.1	60	68.2	1	1.1
Very small (<4 mm)	10	-	-	-	-	5	50.0	5	50.0
Total	635	160	25.7	319	50.7	147	22.5	9	1.1

Data analysis showed that lambs from batches with large curls and medium possess curls and classification more valorous than the lambs with small and very small curls. The best classification they had lambs with large curls. The share of lambs elite in this batch was 44.1% compared to 25.2% in the batch with medium curls and 4.6% in the batch with small curls, which is more by 18.9 and, respectively, 39.5 % ( $P < 0.001$ ). Also, in this batch was recorded and the lowest frequency (12.5%) of lambs from class II (low) compared to other batches. The lowest classification had the lambs with very small curls, large and small. Most lambs in these batches are lower classes (class II and brac). Thus, the batch of lambs with very small curls were recorded 50% individuals from class II and 50% of brac lambs, in the batch of lambs with large curls were recorded class II 70% of individuals and 15% - brac, in the batch with small curls were 68.2% individuals class - II and 1.1% - brac.

Therefore, generalizing research results concerning size of curls and relation on this character with skin qualities in general we conclude that request of skin with large and medium curls and not valued of skin with small curls is explained by the fact that the first skins possess more valorous qualities compared to the other. Based on this research, these were included in the assessment scale Instructions medium and large curls to score higher, respectively, 5-7

and 8-10 points. For selection and reproduction in batches of breeding of selection and reproduction in breeding to create the desired type, have been proposed the lambs with medium and large curls.

## CONCLUSIONS

1. In the Republic of Moldova, Karakul skin with medium curls (6-8 mm), large (9-12 mm) and very large (> 12 mm) have a higher preference value, compared to skin with small and very small curls.

2. With increasing viewing distance of skin from 3 m to 10 m their preference value decreases depending on the size of the curls, more substantially at the skin with small and very small curls, at the black from 17.0 to 34.0% and at the grayish skin with 24,4 – 26,3%. While at the skin with medium, large and very large curls the preference value decrees more moderate at the black - with 7.0 to 16.9%, and at the grayish with 20.3 to 23.8%.

3. Given the amount of preference value of Moldavian Karakul skin width (size) medium and large of curls have been considered requested characters, but small and very small size have been considered undesirable characteristics.

4. Despite the fact that large curls have been obtained in questionnaires experiment value preference high enough, this category of curls size was not recommended as requested, because the research have been demonstrated that, very large category of

curls is in negative correlation with a number of qualities of curls and skin in general.

5. For selection and reproduction in breeding batches to create the type of Moldavian Karakul sheep have been recommended the lambs from higher classes with medium and large curls after width.

## REFERENCES

- [1] Adametz L. Ueber den angeblichen Einfluss der Steppenklimas und Steppenfutters Bocharas auf das Zustandekommen und die Erhaltung der Karakullocke. Sonderabdruck aus der Zeitschrift für das landwirtsch. Versuchsweisen in Oesterreich. H. 3., Wien, 1911.
- [2] Adametz L. Über die Herkunft der Karakulschafe Bocharas und die Entstehung der Lockenbildung am Lammvliese dieser Rasse. Zeitschrift für Tierzucht und Zuchtungsbiologie. Band VIII, 1, Wien, 1927.
- [3] Buzu I., Zelinschi N., Evtodienco Silvia. Instrucțiuni de bonitare a ovinelor Karakul cu principii de ameliorare în Republica Moldova (în două limbi: Md și Ru). Departamentul Edituri, Poligrafie și Comerțul cu Cărți al Tipografiei Centrale. Chișinău, 1996, 72 p.
- [4] Buzu I. Calitățile de pielică a micilor Karakul în funcție de mărimea buclei. Simpozion Științific Jubiliar Internațional „65 ani ai Universității de Stat din Moldova”. Lucrări științifice din 7-9 octombrie 1998. Chișinău, 1998, p. 61-64
- [5] Buzu I. Tip de ovine Karakul Moldovenesc Corpulent: teoria și practica creării și perfecționării. Academia de Științe a Moldovei, Tipog. „Elena V.I.”, Chișinău, 2012, 514 p.
- [6] Nicov Th. Die Karakulzucht in Rumänien. z. Halle, 1936, 213 p.
- [7] Pascal C. Tehnica aprecierii și evaluării performanțelor productive la ovine și caprine. Editura „Alfa”, Iași, 2007, 268 p.
- [8] Taftă V. Tehnica evaluării performanțelor productive la ovine. Ed. “CERES”, București, 1998, 203 p.
- [9] Васин Б. Н. Каракульская овца. Москва, 1936, 53 с.
- [10] Васин Б. Н., Васина-Попова Е. Т., Грабовский И. Н. Руководство по каракулеводству. Изд. «Колос», Москва, 1971, 320 с.
- [11] Васин Б. Н. Цветной каракуль. Изд. «Международная книга», Москва, 1946, 102 с.
- [12] ГОСТ 8748-70 – Каракуль чистопородный черный невыделанный. Технические условия (GOST 8748-70, Undressed pur-bred black Karakul, specifications).
- [13] ГОСТ 2865-68 – Каракуль чистопородный серый невыделанный. Технические условия (GOST 2865-68, Grey undressed persian lamb of pure breed, specifications).
- [14] Демянко В.Я. Каракульская овца. Изд. Бессарабского Губернского Земства. Кишиневъ, 1912, 14 с.
- [15] Дьячков И. Н., Письменная Р. Т. Новая классификация каракульских вальковатых завитков и гривки. Сообщение 1-е. Труды ВНИИ Каракулеводства, т. V, 1951, с. 135-213.
- [16] Дьячков И. Н., Письменная Р. Т. О морфологическом строении и типах вальковатых завитков. «Каракулеводство и звероводство», 1952, № 2, с. 24-30.
- [17] Закиров М.Д. Каракульские шкурки и методические основы их оценки. Автореферат докт. дисс. Дубровицы, 1975, 152 с.
- [18] Иванаев И. Наблюдения из практики каракульского овцеводства. Изд. журнала «Хозяин», СП б, 1905.
- [19] Иванов М. Ф. Каракулеводство на югъ России. Полтава, 1914, 246 с.
- [20] Иванов М. Ф. Овцеводство, Москва, 1915.
- [21] Иванов М. Ф. Сортировка черных каракульских смушков и ее научные основы. Полное собрание сочинений, том 3. Москва, «Колос», 1964, с. 376-398.
- [22] Иванов М. Ф. Строение завитков серых и цветных каракульских смушков по длине и тонине их волос. Полное собрание сочинений, том 3. Москва, «Колос», 1964, с. 442-457.
- [23] Иванов М. Ф. Овцеводство. Полное собрание сочинений, том 3. Москва, изд. «Колос», 1964, с. 15-26.
- [24] Инструкция по бонитировке каракульских ягнят с основами племенного дела. Изд. «Колос», Москва, 1974, 32 с.
- [25] Инструкция по бонитировке каракульских овец с основами племенного дела. Изд. ВНИИ Каракулеводства, Самарканд, 1989, 83 с.
- [26] Кошевой М. А. Селекция и условия разведения каракульских овец. Ташкент, изд. «Фан», 1975, 247 с.
- [27] Кузнецов Б.А. Каракуль и смушка. Основы товароведения. Москва, 1956.
- [28] Петров Н.В. Смушковое овцеводство. «Вестник русского сельского хозяйства», С.-Петербург, 1888, № 7, с. 689-704.
- [29] Плохинский Н.А. Руководство по биометрии для зоотехников. Изд. «Колос», Москва, 1969, 256 с.
- [30] Синицын И.В. О скрещивании «малича» с каракулевой «араби». Вестник Общественной Ветеринарии. Харьков, 1889, № 23.
- [31] Синицын И.В. Крымская овца «маличь» и бухарская каракулевая «араби». Диссертация, Юрьев, 1900.
- [32] Тихомиров В.А. Каракульские овцы в Полтавской губернии. Полтава, 1886.