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Histological Structure Of The Skin And Wool Productivity Of Sheep Of The Grozny Breed, Depending On The Folding Of The Skin.

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ABSTRACT

In the Russian Federation, according to the "Procedure and conditions for appraisal of fine-wool breeds of sheep" approved by the Ministry of Agriculture on October 5, 2010, by order No. 335, fine-fleeced sheep, according to the type of animal and folding of the skin, are divided into three groups: animals with insufficient folding of the skin that evade the meat type (C-); animals with increased folding on the neck and trunk, deviating to a woolly type (C +). The purpose of this work was to determine the appropriateness of selecting newborn lambs of the Grozny breed by the type of skin folding. The research was carried out during the period from 2014 to 2017 in the Limited Liability Company "Plemozvod "Chervlenye Buruny" of the Republic of Dagestan. During the lambing period on day 1-3 after the birth, 480 single and double lambs of both sexes were selected, which were previously divided into three groups according to the type of skin folding. It was found that the thickness of the skin of multi-folded animals at the age of 18 months was 3115.6 µm, normal folded - 3056.8 µm and non – folded - 2864.1 µm. The number of all hair follicles per 1 mm^2 of skin was 82.9, 80.1 and 65.1 pieces respectively. The percentage of yield of pure wool was greatest in non – folded sheep (54.9 -56.71%) and the lowest - in multi-folded (51.64 -55.96%). The true length of the wool on the side at the age of 13 months in single ewes of the type "C-" was 14.50 cm, type "C" - 14.45 cm and type "C +" - 12.24 cm. Animals of the type "C-" stand in the first place in the strength of wool, this indicator in their topographic areas is equal to: side - 7,48, back -6,18, belly -5,1 and thigh -6,91 km. Strength of wool of the type "C" in the areas were, respectively, 6.64, 5.56.4.84 and 6.55 cN / tex, and of the type "C +" - 6.12; 5.25; 4.48 and 5.76 cN / tex.

Keywords: Skin structure, skin folding, epidermis, pilar layer, follicle, wool density, wool cutting, wool output, wool fiber thickness, natural length of wool, true length of wool, crimp.

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INTRODUCTION

Sheep breeding is one of the traditional branches of livestock and a source of valuable products like milk, meat, as well as raw materials for the country's national economy - wool, lambs, sheepskin, leather, etc.

Raising the level of production of sheep products and improving its quality are the main tasks of science and practice in the field of this unique industry. Intensification of the breeding process, along with improving the conditions for feeding and keeping animals, improving the production technology play an important role in solving these problems [1].

Currently, in the agricultural organizations of the Russian Federation, the gene pool is 41 breeds of sheep, of which 15 are fine wool, the number of which was 2 million 361.6 thousand heads or 56.7% of the total number of sheep. The most numerous breeds among fine-wooled sheep are the Dagestani mountain (845.5 thousand heads) and Grozny (728.7 thousand heads) [2].

Leading role in the production of sheep products belongs to the North Caucasus, where the main breeding herds of sheep are concentrated, which had a great influence on the improvement of sheep in many regions of Russia. However, the production of sheep products became unprofitable after 1990. This caused a sharp reduction in the number of sheep. In this regard, it is important to increase its competitiveness in the world market under new conditions. It can be achieved by accelerating the selection and technological methods of improving the industry. According to the authors, the most effective step in this direction is the early diagnosis of sheep productivity, which significantly reduces the interval between generations and increases the intensity of the breeding process.

In the practice of breeding sheep abroad, much attention is given to the type of sheep. Separation of sheep into types is based on the development of skin on the body, primarily on the number and size of the anterior folds, taking into account the presence of possible folds on the back of the animal's torso. The folds on the front of the trunk are more prominent than in the rest of the body, especially in sheared sheep. For this reason, and also due to the relationship between folds on different trunk articles, the front folds can be used as a criterion in the classification of Merino sheep [3,4].

Skin folding can directly determine the productive qualities and profitability of the industry in advanced sheep breeding countries such as Australia, New Zealand, South Africa, Uruguay and others. The type of sheep is determined by the number and size of the front folds, thus drawing attention to possible anatomical folds on all parts of the trunk. The folds themselves are classified mainly in 4 types: 1) jaws; 2) frontal folds; 3) folds of the body and 4) caudal [5,6,7].

In the Russian Federation, according to the " Procedure and conditions for appraisal of fine-wool breeds of sheep" approved by the Ministry of Agriculture on October 5, 2010, Order No. 335, fine wool sheep, according to the type of animal and skin folding, are divided into three groups: animals with insufficient folding of the skin, type (C-); animals with increased folding on the neck and trunk, deviating to the wool type (C +): animals that meet the requirements of the desired type of breed for the expression of wool and meat productivity [8].

The purpose of the study was to determine the appropriateness of selecting newborn lambs of Grozny breed by the type of skin folding.

The research task was to study the productive and some biological features of sheep, differing in the type of folding of the skin at an early age.

MATERIAL AND METHODS OF RESEARCH

The research was conducted between 2014 and 2017 in the Limited Liability Company "Plemvoz" "Chervlennyi Buruny" of the Nogai District of the Republic of Dagestan.

During the lambing period on day 1-3 after the birth, 480 single and double lambs of both sexes were selected, which were previously divided into three groups according to the type of skin folding.

Lambs with insufficient stock of skin were classified to the type "C-" (non- folded animals), characterized by the absence of folds on the neck, along the trunk and at the root of the tail. A weakly developed longitudinal crease of the wool along the neck was allowed.

Lambs with a satisfactory supply of skin, which was characterized by the presence of two or three large full or incomplete transverse folds on the neck, up to 7-8 small folds on the sides and a medium-developed "rosette" at the tail root were of the "C" type (normally folded animals). Folds on the sacrum and thighs were allowed only in the form of wrinkles.

Lambs with an increased stock of the skin, forming large densely folded folds on the neck, sides, sacrum, thigh and tail root, were referred to "C +" type (multifold animals). The total number of folds along the body was on the average 15-16, and on the neck 7-8.

In the following, the description and assignment of lambs to a certain type of folding was carried out at a pile at the age of 4.5 months, before staging at the winter stall maintenance at the age of 9 months, during the period of boning at the age of 13 months and 18 months of age.

Wool productivity was studied at the age of 13 months by individually recording the cuttings during the cutting of the experimental young. At the same time, wool samples were taken to determine the yield of pure fiber. The percentage of yield and wool shaving was determined individually from each animal [9]. The yield of pure wool was determined in 280 runes of ewes and rams of different types of skin folding.

- the density of the sheep's wool was determined by counting the hair follicles per unit area of the horizontal sections of the skin taken from the animals on the right side, with an increase in the microscope (eyepiece 15 x objects 3), at birth, at the age of 4.5, 9, 13 and 18 months, as well as expertly during the inspection;

- the content of wool fat and mechanical impurities were determined from the samples of the wool of the sides of the experimental groups of 5 heads each;

- the natural length of the wool was determined at birth, at the age of 4.5, 9 and 13 months with an accuracy of 0.5 cm in the following topographic areas: side, shoulder blade, back, belly and thigh. The true length was determined from the samples of wool in the laboratory on the apparatus TUR 4-10-1-26;

- The thickness of the wool was determined by measuring the diameter of the wool on the pressure gauge, with an increase of 500 times. In total, more than 80,000 woolens on the side were measured during these same age periods and at the age of 13 months on the side, back, belly and thigh;

- the wool strength was determined on a dynamometer DZH -3 on the samples of wool taken from single ewes at the age of 13 months (during the appraisal), from the following topographic areas: side, back, belly, thigh, in 10 heads from each group;

- the crimp of the wool was determined by counting the number of twists per unit length of the side of the fur in a natural, undisturbed state.

Collection of material for histological examination of the skin, processing and analysis of it were carried out according to the method of NA. Diomidova, E.P. Panfilova and E.S. Suslina [10]. The number of hair roots per 1 mm^2 was studied on horizontal sections.

The total thickness of the skin and its individual layers was studied on the vertical skin sections. The total thickness of the skin and the thickness of its layers (the pilar and the reticular) were measured with an increase: eyepiece x 7, objective x 8. The thickness of the cover epithelium was measured with an increase: eyepiece x 10, objective x 40. Measurement of the thickness of the layers of the skin was carried out in 10 measurements from each sample.

To account for the growth of the wool, before the lambs were set up, the wool was cut out on an area of 100 cm^2 (10 x 10 cm) on the left side of each type with 5 young heads of sheep. At the end of the

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experiment, the wool grown on this site was sheared and determined: the increase in wool in the original and in pure fiber, the yield of pure wool in%, the natural and true length of the wool, the wool tone.

RESULTS OF THE RESEARCH AND THEIR DISCUSSION

The sheep skin is closely related to the constitution, and also follows the criterion for assessing the direction of animal productivity. The skin performs a protective function, plays an important role in thermoregulation and is involved in the metabolism. Skin of sheep as the skin of other mammalian animals consists of: a covering epithelium or epidermis, a pilar and reticular layer or a mesh layer [11-16].

It can be seen from the data in Table 1that at birth by the total thickness of the skin, multi-folded ewes exceeded normal folded sheep by 5.8, and their indices were also greater than those without folded ones by 9.7%. This advantage has been preserved in all age periods. The difference in the thickness of the skin between extreme types at 18 months of age is statistically significant, and in other age periods is close to reliable.

Table 1: Thickness of the skin and its layers in experimental ewes, µm

Age	Type of folding					
	C-		C		C+	
	M ± m	C	M ± m	C	M ± m	C
Total thickness						
At birth	1764,8 ± 69	12,4	1829,0 ± 56	9,7	1935,6 ± 88	14,5
4,5 months	2284,1 ± 110	15,3	2415,5 ± 74	9,6	2563,9 ± 101	12,5
13 months	2606,4 ± 89	10,2	2739,1 ± 118	13,0	2867,9 ± 120	13,2
18 months	2864,1 ± 88	9,2	3056,8 ± 85	8,6	3115,6 ± 74	7,2
Thickness of the epidermis						
At birth	16,6 ± 0,79	15,1	16,6 ± 1,31	5,8	18,3 ± 0,96	11,1
4,5 months	20,0 ± 0,83	13,0	20,4 ± 0,82	12,7	20,5 ± 0,70	10,3
13 months	20,5 ± 0,73	10,6	20,2 ± 0,97	14,4	20,7 ± 0,76	11,6
18 months	22,1 ± 1,10	14,9	23,3 ± 1,28	12,3	23,6 ± 1,07	11,6
Thickness of the pilar layer						
At birth	1221,9 ± 44	11,4	1295,5 ± 32	7,7	1386,0 ± 62	14,0
4,5 months	1400 ± 55	12,5	1465,8 ± 28	6,1	1535,4 ± 69	13,4
13 months	1503,2 ± 34	6,8	1643,4 ± 71	13,0	1632,2 ± 61	11,9
18 months	1661,8 ± 36	6,4	1686,1 ± 65	11,6	1724,2 ± 80	13,9
Thickness of the reticular layer						
At birth	526,3 ± 31	18,4	516,9 ± 38	23,6	531,3 ± 39	23,1
4,5 months	863,1 ± 73	26,7	930,3 ± 69	23,3	1008,0 ± 54	16,0
13 months	1082,7 ± 79	21,9	1075,5 ± 60	16,6	1215,0 ± 92	23,9
18 months	1180,2 ± 69	17,5	1347,4 ± 58	13,0	1367,8 ± 42	9,3

Studies of post-uterine growth of the skin in thickness show that the highest growth rate in all groups of animals is observed in the suckling period. Compared to other groups at this time, the intensity of skin growth in thickness was the lowest in non-folded animals. In the remaining age periods, folded animals had the smallest intensity of skin growth in thickness. However, despite this, the thickness of the skin in animals of "C +" type in all age periods, as mentioned above, is superior to the skin thickness of peers of other types.

It can be seen from the data of Table 1 that the thickness of the epidermis in animals of the "C +" type was higher than in the other types for all age periods, but biometric processing of the obtained data did not reveal a reliable difference between animals of different types of folding.

Studies of age-related changes in the thickness of the epidermis made it possible to establish that the greatest intensity of its growth in the post-uterine period is observed from birth to separation from mothers

and is 22.3, 22.9 and 12, respectively, in animals of the types "C-", "C" and "C + 0%. Subsequently, the thickness of the epidermis remains approximately at the same level in all groups of animals from 4.5 to 13 months of age, and it slightly increases in the period from 13 to 18 months of age.

The pilar layer is the main part of the skin. It contains blood vessels, hair follicles, glandular apparatus and the formation and development of wool. The age-related changes in the thickness of this layer are shown in Table 1. The pilar layer in animals of the "C-" type at birth from the total thickness of the skin was 69.24, and in animals of the "C +" type was 71.61%, "C" type on this indicator occupied the middle position.

As can be seen from the data presented, the thickness of the pilar layer at birth was the largest in lambs of the "C +" type, and this regularity persists even in the following age groups.

The thickness of the pilar layer increases with age. So, if the thickness of pilar layer of ewes at birth is taken as 100%, then at the age of 18 months, it amounted to 136.0% ("C-" type ewes), 130.2% ("C" type) and 124.4% ("C +" type). This indicates that the intensity of growth of the pilar layer of ewes of the "C +" type in the post-uterine period was lower than in other types of sheeps. In addition, this indicates a more intensive growth in the period of uterine development of the animal.

As a result of investigation of the thickness of the reticular layer, it was established that there is no significant difference in this parameter in ewes of different types of folding at birth (Table 1). There is an uneven thickening of the reticular layer in ewes of all types of folding with age. The smallest increment was noted in non-folded animals. The thickness of the reticular layer at 18 months of age, compared with the newborns, increased in the ewes of the "C-" type by 2.24 times, in the sheep of the "C" type by 2.61 times and in the sheep of the "C +" type by 2.57 times. It can be concluded from these data that the reticular layer, in comparison with other layers of the skin, in the post-uterine period is the most intensively developing layer.

Conducted studies of the density of follicles in ewes of different types of skin folding (Table 2) show that lambs of a multi-fold type at the birth, compared to others, had more follicles per unit area of the skin. Later, at all ages, they also had a greater number of hair roots and their rudiments per 1mm2 skin. At birth, sheep type "C +" had more hair follicles than animals of types "C" and "C-", respectively, by 31.3 and 41.9% (P>0,99)This advantage was between the groups of ewes at the age of 18 months, which between the latter types was 27.3%.

Analysis of the data in Table 2 also shows that with age, there is a decrease in the number of follicles per unit area of the skin. Thus, in non - folded ewes during the period from birth to 4.5 months of age, the total number of follicles in an area of 1 mm^2 decreased by 2.08 times; in animals of types "C" and "C +" during this period, the decrease was 2.03 and 2.44 times.

Table 2: Density of follicles to the skin of experimental ewes, pcs

Types of animals	Age, months					
	rudiments		roots		total	
	M ± m	C	M ± m	C	M ± m	C
At birth						
C-	133,5 ± 2,81	21,0	63,1 ± 1,12	17,8	196,6 ± 3,20	16,3
C	144,3 ± 3,26	22,6	70,6 ± 0,55	13,4	214,9 ± 3,96	18,4
C+	189,5 ± 3,66	19,3	89,5 ± 1,78	19,9	279,0 ± 4,29	15,4
4,5 months						
C-	23,2 ± 2,20	30,3	73,5 ± 5,56	23,9	96,7 ± 5,82	20,1
C	27,2 ± 1,15	13,3	76,3 ± 3,08	18,8	103,5 ± 3,09	9,44
C+	24,9 ± 0,97	12,3	88,6 ± 4,64	16,6	113,5 ± 4,50	12,4
9 months						
C-	5,8 ± 0,70	38,1	74,5 ± 2,20	9,3	80,3 ± 2,24	8,8
C	3,5 ± 0,34	30,9	87,0 ± 2,20	11,6	90,5 ± 2,35	8,2
C+	5,5 ± 1,20	69,6	88,0 ± 2,90	10,6	93,5 ± 3,09	10,5

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13 months						
C-	2,7 ± 0,67	74,0	72,8 ± 3,15	13,0	75,5 ± 3,30	13,1
C	3,2 ± 0,37	36,9	77,6 ± 2,40	9,9	80,8 ± 2,75	10,8
C+	2,40 ± 0,59	77,9	80,8 ± 3,69	14,5	83,2 ± 4,08	15,5
18 months						
C-					65,1 ± 2,40	11,1
C					80,1 ± 3,90	15,4
C+					82,9 ± 2,70	10,4

Subsequently, from 4.5 to 18 months of age, the total number of follicles per unit area of the skin also decreases, but much more slowly. During this period, the density of follicles decreased, respectively, in 1,48, 1,29 and 1,37 times. For the entire period from birth to 18 months of age, the density of follicles decreased in animals of the "C-" type in 3.02, "C" type in 2.68 and "C +" type in 3.90 times.

It can be seen from the results obtained that in animals of a multi-fold type, the number of follicles per unit area of the skin decreases most. O.N. Diomidov [17], G.S. Avsadzhanov [18, 19], P.P. Kornienko [20,21,22] believe that the decrease in follicles is associated with an increase in the area of the wool field, and the total potential of the follicles laid during the intrauterine development of the animal remains almost unchanged in the post-uterine period.

The authors also studied the formation of wool fibers from rudimentary follicles. Studies have shown that a certain regularity in the formation of fibers from rudimentary follicles, depending on the type of folding of the skin, was not observed in the experimental animals.

The length of the wool is a very important sign of its quality. The industrial use of wool, the quality of the yarn obtained from it, and the cost of the wool depend on the length. [23] A lot of work has been done to study the relationship of skin folding to the length of the wool. Almost all researchers note a decrease in the length of the wool with an increase in the folding of the skin.

The data presented in Table 3 confirm this pattern. Thus, for example, the natural length of the single ewe's wool at the age of 13 months was almost the same in all topographic areas without folded and normally folded sheep, the difference is statistically unreliable.

Table 3: Natural length of wool of experimental young animals, cm

Sex	Type of birth	Skin folding type	Topographic skin area			
			side	scapula	back	belly
At birth						
Ewes	single	C-	0,05	0,62	0,82	1,11
		C	0,77	0,62	0,69	0,90
		C+	0,55	0,48	0,61	0,73
	double	C-	0,79	0,68	0,74	1,01
		C	0,85	0,80	0,80	0,94
		C+	0,48	0,43	0,48	0,56
Rams	single	C-	0,86	0,63	0,89	1,15
		C	0,78	0,59	0,80	0,68
		C+	0,61	0,51	0,64	0,70
	double	C-	0,73	0,52	0,70	0,87
		C	0,54	0,46	0,54	0,70
		C+	0,45	0,39	0,45	0,57
4,5 months						
Ewes	single	C-	4,34	4,33	4,26	3,41

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		C	4,33	4,32	4,16	3,57
		C+	3,15	3,18	3,10	2,85
	double	C-	4,33	4,33	4,08	3,47
		C	4,22	4,13	4,11	3,67
		C+	3,06	3,03	3,00	2,88
Rams	single	C-	4,42	4,25	4,00	3,66
		C	4,40	4,39	4,32	3,44
		C+	3,72	3,50	3,40	3,14
	double	C-	4,13	4,03	4,14	3,14
		C	4,37	4,48	4,50	3,28
		C+	3,42	3,32	3,23	3,08
9 months						
Ewes	single	C-	6,36	6,43	6,21	5,69
		C	6,28	6,33	5,79	5,72
		C+	4,97	4,98	4,77	4,68
	double	C-	6,17	6,28	5,86	5,58
		C	6,02	6,09	5,63	5,40
		C+	5,00	5,03	4,75	4,50
Rams	single	C-	6,25	6,22	5,80	5,41
		C	6,06	5,98	5,71	5,56
		C+	5,36	5,40	5,06	4,96
	double	C-	6,11	5,98	5,66	5,26
		C	6,25	6,20	5,70	5,64
		C+	5,00	5,27	4,77	4,81
13 months						
Ewes	single	C-	9,64	9,76	8,27	7,65
		C	9,42	9,43	8,27	7,80
		C+	7,85	8,04	7,37	7,00
	double	C-	9,50	9,23	8,50	7,28
		C	9,20	9,45	8,00	7,42
		C+	7,77	8,00	7,23	7,00
Rams	single	C-	10,28	10,49	8,52	8,25
		C	9,89	9,99	8,10	8,24
		C+	8,86	9,12	7,38	7,19
	double	C-	9,58	10,03	8,32	7,72
		C	9,51	9,95	8,10	8,12
		C+	8,50	8,64	7,05	7,45

According to the natural length of the wool, the multifolled animals in all the above topographical areas were inferior to the animals of two other types. Excellence without folded animals over folded on the side was 22.8, on the scapula - 21.4, on the back - 12.2, on the belly - 9.3 and on the thigh - 25.7%, and the superiority of normally folded over multifolded was, respectively, 17.3; 12.2; 11.5 and 20.3%; the indicated differences are statistically significant (P>0,99), a similar pattern exists for both single rams and double ewes.

The pattern that was observed in the natural length of the wool in the young at the age of 13 months is also preserved according to the true length of the wool (Table 4). Thus, if one compares the true length of animal hair without a folded type with normally folded animals, it can be seen that there is no significant difference in all topographic areas. A different picture is observed between many-folded and two other types of animals. As in the case with the natural length of the wool, animals like "C +" were inferior to the other two types. The results of measurements of the height of the staple (Table 3) show that the length of the wool in different topographic areas of animals, even within the same type of folding, is not the same. The greatest natural length of the hair was on the scapula, the smallest on the belly, the latter as a percentage of the length of the wool on the side was 101-103 and 76.6-90.1%, respectively.

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Determination of the true length of the wool (Table 4) showed that the length of the hair on the back is 91.9 - 96.5%, on the belly 90.3 - 90.4%, on the thigh 92.6 - 99.8%% (in percentage of the length of the wool of the sides).

Table 4: The true length of sheep's ewes at the age of 13 months, cm

Type of animal	Topographic area	Ewes					
		single			double		
		M ± m	σ	c	M ± m	σ	c
C-	side	14,50 ± 0,07	2,22	15,3	13,70 ± 0,06	1,76	13,3
	back	13,33 ± 0,06	1,89	14,2	13,17 ± 0,05	1,68	12,8
	belly	13,10 ± 0,06	1,98	15,1	12,72 ± 0,06	1,91	15,0
	thigh	13,94 ± 0,06	1,90	13,6	13,70 ± 0,05	1,72	12,5
C	side	14,45 ± 0,06	1,86	12,9	13,76 ± 0,06	1,74	12,6
	back	13,48 ± 0,06	1,76	13,0	13,29 ± 0,05	1,68	12,7
	belly	13,36 ± 0,07	2,09	15,7	13,13 ± 0,06	1,75	13,4
	thigh	13,80 ± 0,06	2,00	14,4	13,47 ± 0,06	1,78	13,2
C+	side	12,24 ± 0,07	2,09	17,1	11,31 ± 0,07	2,20	19,6
	back	11,49 ± 0,06	1,97	17,2	10,2 ± 0,07	2,23	20,4
	belly	11,56 ± 0,06	1,96	17,0	11,14 ± 0,06	1,83	16,4
	thigh	11,33 ± 0,05	1,60	14,1	11,06 ± 0,05	1,71	15,5

From the data in Table 5, showing the increase in wool in animals due to the degree of folding of the skin, it can be seen that in animals without a fold type, the length of the wool was the largest. So, if the increase in wool from birth to 13 months of age in a sheep without a folded type is taken as 100%, then this indicator will be respectively 87.03 and 83.03% in single ewes of the normal-folded and multi-folded types, and 95.88 and 83.71% double ewes, a similar pattern was observed in single rams.

Table 5: Growth of natural length of wool on the side in ewes due to folding

Periods	Indicators	Ewes					
		single			double		
		C-	C	C+	C-	C	C+
Birth - 4.5 months	in fact, cm	3,490	3,562	2,597	3,554	3,372	2,588
	in% of total increase	39,8	40,8	35,6	40,1	40,5	35,5
4,5 – 9 months	in fact, cm	2,024	1,951	1,817	1,837	1,802	1,937
	in% of total increase	23,0	22,6	24,9	21,9	21,5	26,5
9 – 13 months	in fact, cm	3,227	3,139	2,889	3,330	3,178	2,767
	in% of total increase	37,2	36,6	39,5	38,0	38,0	38,0
Birth – 13 months	in fact, cm	8,791	8,652	7,229	8,711	8,352	7,292
	in% of total increase	100	100	100	100	100	100

Double rams of the normally folded type for wool growth energy were in front without folded animals, and multifold, like the same ones, had the lowest growth energy of the wool.

As can be seen from the data in Table 5, the greatest increase in wool in length is noted in the period from birth to weaning from mothers. After the separation of lambs from mothers, the growth energy of the wool sharply decreases, which apparently was influenced by the removal of lambs from mothers and a sudden shift to plant food. In the future, in the period from 9 to 13 months, the increase in wool raises.

The thickness of the wool of the experimental young sheep was examined at birth, at the age of 4.5; 9; 13 and 18 months. From the data in Table 6, it can be seen that from birth to churning, all the experimental groups experienced an increase in the diameter of the wool, but there is no definite regularity in the change in the diameter of the wool due to the folding of the skin. It can be noted that the increase in wool in thickness

was less in the case of non-folded animals, compared with multi- folded and normally folded animals. Thus, the percentage of growth in the diameter of the wool in this period was 18.7% in single ewes of the type "C-"; 23.4% in sheep type "C" and 19.7% in sheep type "C +". There was a thinning of the wool from the separation of lambs from mothers to shearing.

Table 6: Wool thickness on the sides of experimental young sheep, µm

Sex	Type	Young sheep								
		Single					double			
		при рожд.	4,5 мес	9 мес.	13 мес.	18 мес.	при рожд.	4,5 мес	9 мес.	13 мес.
Ewes	C-	18,1	21,5	19,0	18,7	20,06	18,3	19,8	17,7	18,7
	C	17,6	21,7	19,4	18,6	20,85	16,9	21,0	19,2	18,6
	C+	18,1	21,6	20,3	19,1	23,06	18,3	21,6	19,8	19,2
Rams	C-	17,6	19,8	18,8	18,4	-	17,4	20,0	18,6	18,5
	C	17,7	21,5	19,3	18,1	-	16,3	20,7	19,0	18,8
	C+	16,8	21,3	19,6	19,3	-	17,4	20,3	18,1	18,6

At the age of 13 months, the largest diameter of the wool was of a multi-fold type. The difference between the last types was 0.4 microns in single ewes, and 0.5 µm (P>0,95) between “C” + and “C-” type animals. Approximately the same regularity was found in single rams. In the group of double ewes and rams, the largest diameter of wool was in animals of a multi-fold type; the lowest tonicity was found in animals of the "C-" type.

In the period from 13 to 18 months, a sharp increase in the diameter of the wool was observed, which, apparently, is associated with better nutrition. The diameter of the wool of the ewes type "C +" is increased by 3.96 microns, or by 20.7% during this period. In animals of the type "C" and "C-", the increase in the diameter of the wool was 12.7%.

The coarse wool at the age of 18 months had animals of the "C +" type, while the diameter of the wool of the "C" and "C" types was less than 2.21 and 3.0 microns, or 10.6 and 15.0 % (P>0,99).

Table 7: Thickness of the wool of young sheep at the age of 13 months, mkm

Type of animal	Topographic area	Ewes		Rams	
		single	double	single	double
C-	side	18,7 ± 0,15	18,4 ± 0,17	18,7 ± 0,13	18,5 ± 0,13
	back	18,7 ± 0,15	18,4 ± 0,18	18,9 ± 0,13	19,4 ± 0,14

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	belly	18,8 ± 0,14	18,2 ± 0,17	18,6 ± 0,14	18,2 ± 0,13
	thigh	20,2 ± 0,17	19,1 ± 0,15	19,8 ± 0,16	20,4 ± 0,17
C	side	18,6 ± 0,13	18,0 ± 0,12	18,8 ± 0,13	18,8 ± 0,13
	back	18,8 ± 0,19	18,4 ± 0,14	18,7 ± 0,14	19,7 ± 0,17
	belly	18,3 ± 0,15	18,1 ± 0,13	18,1 ± 0,14	17,6 ± 0,13
	thigh	19,1 ± 0,17	19,7 ± 0,15	19,3 ± 0,16	19,9 ± 0,18
C+	side	19,1 ± 0,16	19,3 ± 0,18	19,2 ± 0,16	18,6 ± 0,15
	back	18,5 ± 0,18	18,9 ± 0,17	18,1 ± 0,16	17,6 ± 0,16
	belly	18,3 ± 0,15	18,3 ± 0,15	18,4 ± 0,13	17,8 ± 0,15
	thigh	19,9 ± 0,19	20,0 ± 0,20	20,8 ± 0,18	19,4 ± 0,16

The thickness of the wool was also determined in different topographic areas at the age of 13 months. The data in Table 7 show that the thickness of the wool in different topographic areas is not the same. Thus, the coarse wool of all sheep was on the thigh (19.1-19.3 µm), the thinner was on the sides (18.0-19.3 µm). The diameter of the wool on the back and the belly, in percentage to the wool tone of side, was 100.0% and 100.5% in the single ewes type "C-"; 101.1% and 98.4% in single ewes type "C"; and 96.8% and 95.8% in single ewes type "C +". The diameter of the wool on the thigh was, compared with the side, 108.0, 102.7 and 104.2% for single ewes, respectively. Approximately the same pattern is noted for the remaining groups of animals.

It should be emphasized that all young sheep, except for single ewes type "C-" and rams type "C +", had the highest thickness of wool on the belly (20.8 -18.6) µm).

According to the strength of wool, the technological properties of wool are usually evaluated. H.E. Kesaev et al. [24, 25] indicate that the strength of wool is closely related to the technological properties of wool and determines its production purpose.

It can be seen from the data in Table 8 that the most durable wool of ewes of all types of folds was on the sides. The strength of the wool on other topographic areas was distributed as a percentage of the strength of the side wool as follows: the back - 82-85; belly-68-73; thigh -92- 98%.

Table 8: Strength of wool of experimental ewes at the age of 13 months, cN / tex

Type of folding	Topographic area			
	side	back	belly	thigh
C-	7,48 ± 0,30	6,18 ± 0,28	5,14 ± 0,38	5,91 ± 0,27
C	6,64 ± 0,38	5,56 ± 0,21	4,84 ± 0,35	6,55 ± 0,33
C+	6,12 ± 0,22	5,25 ± 0,22	4,48 ± 0,28	5,76 ± 0,23

The highest values of wool strength in all topographic areas were recorded in ewes type "C-". When comparing the strength of the wool on the sides of ewes type "C-" with the same indices of the types "C" and "C +", it is evident that the former were superior to the latter by 12.6 and 22.2%, but the difference is only reliable between the last types . The same regularity existed between other topographic areas, except for the wool of the belly.

It can be seen from the data in Table 9 that the excess of the true length of the wool over the natural height of the staple in ewes of the "C +" type on the sides, back and thigh was higher than ewes of the "C-" type sheep, respectively, by 5.4; 2,1 and 3,2%, while this indicator in animals of the "C-" type on the belly had approximately the same value with animals of the "C" type and exceeded indicators of the "C +" type ewes by 6.0%.

To determine the presence of the folding relationship of the skin in sheep with the crimp of the wool, the number of crimps per centimeter of length at the age of 13 months was counted. The data in Table 9 show that the number of wool crimp from the side and back in the case of non-folded sheep was less than that of normally folded and multi-folded types. Wool from the belly, on the contrary, in ewes type "C-" had a greater tortuosity and exceeded that of the "C" and "C +" type ewes, respectively, by 7.9 and 8.0%. A certain regularity was not observed in the tortuosity of the wool from the thigh.

Table 9: Characteristics of crimped wool of single ewes at the age of 13 months

Topographic area	Type of folding					
	C-		C		C+	
	excess of true length over natural length,%	number of crimps per 1 cm length	excess of true length over natural length,%	number of crimps per 1 cm length	excess of true length over natural length,%	number of crimps per 1 cm length
Side	50,4	5,00	53,4	5,50	55,9	5,33
Back	53,8	5,34	63,0	5,40	55,9	5,80
Belly	71,1	6,84	71,3	6,34	65,1	6,33
Thigh	47,5	5,00	52,5	4,90	50,7	5,00

When analyzing the data of tortuosity of wool within the limits of the topographical sections of one animal, it is evident that wool from the belly was the most tortuous, and the smallest from the thigh.

To clarify the tortuosity of the wool of 13-month-old sheep, the number of crimps per centimeter of the length of the wool from the side of the sheep at the age of 18 months was counted. Wool, which grew from the haircut to 18 months, refers to the wool of "good content" and, as a rule, most accurately characterizes the tortuosity of the wool of the animal.

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The data on the tortuosity in this age period confirm the findings of those researchers who point to the great crimpseness of the sheep's wool type "C +" (6.10 crimps per 1 cm in length) compared to the other types of sheep ("C" -5.25 and "C -" - 5.22 crimps per 1 cm in length).

One of the main factors determining the amount of wool is the density of placement of wool fibers on the same skin area. The density of the wool was determined expertly during appraisal and on skin preparations taken from the right side of the ewes in different age periods.

Confirmation of the data of Table 10 on the density of ewe's wool at the age of 13 months on biopsy specimens of the skin is the expert determination of the thickness of the wool at appraisal at the same age. The data presented in Table 10 show that multifolled animals are characterized by the greatest density of wool.

Table 10: Density of the wool of experimental ewes at the age of 13 months (according to the data of appraisal)

Indicators			Groups					
			ewes			rams		
			C-	C	C+	C-	C	C+
Number of animals			58	57	42	70	61	32
Density of wool (%)	very thick	mm	10,4	26,3	64,3	4,3	19,7	50,0
	thick	m	64,7	68,4	35,7	65,7	72,1	50,0
	rare	mr	25,9	5,3	-	30,0	8,2	-

Thus, 64.3% of 42 sheep type "C +" are referred to animals with "very thick" hair, and the remaining 35.7% to "thick". In the group non-folded type, there were a fairly large number of animals with rare wool. 25.9% in the ewes group and 30.0% in the rams group were classified as rarely woolly animals. The animals of the normally folded type occupied an intermediate position in this indicator.

Data on the density of wool confirm that the most densely woolly are animals of a multi-fold type.

Data on the counting of the haircut of the test hair of the experimental young animal are presented in Table 11, which show that normally folded ewes and rams at the age of 13 months had the best wool clipping in the original. Indicators of single ewes of this type exceeded by 0.42 kg the indicators of non - folded type sheep, by 0.29 kg of multi-folded sheep, in both the difference was observed only between animals of types "C" and "C-." The difference is 1.8% in favor of single rams type "C", in comparison with animals of the type "C +", is not reliable. It can also be seen that in the group of single lambs, the animals with the smallest clipping were of the non - folded type.

Table 11: Shearing of wool of experimental sheep

Sex	Type of birth	Indicators	Animal type for skin folding		
			C-	C	C+
Ярки	single	wool shearing in the original, kg	3,82 ± 0,09	4,24 ± 0,09	3,95 ± 0,11
		wool shearing in pure fiber, kg	2,16 ± 0,10	2,41 ± 0,06	2,21 ± 0,06
		% yield of pure wool	56,71	56,90	55,96
	double	wool shearing in the original, kg	3,82 ± 0,13	3,73 ± 0,18	3,97 ± 0,13
		wool shearing in pure fiber, kg	2,16 ± 0,07	2,10 ± 0,04	2,14 ± 0,10

		% yield of pure wool	56,39	56,26	53,82
Баранчики	single	wool shearing in the original, kg	4,29 ± 0,09	4,51 ± 0,06	4,43 ± 0,11
		wool shearing in pure fiber, kg	2,38 ± 0,05	2,46 ± 0,04	2,29 ± 0,06
		% yield of pure wool	55,61	54,45	51,64
	double	wool shearing in the original, kg	4,39 ± 0,03	4,38 ± 0,12	4,58 ± 0,24
		wool shearing in pure fiber, kg	2,38 ± 0,06	2,34 ± 0,07	2,39 ± 0,12
		% yield of pure wool	54,19	53,41	52,09

Another picture is observed in the wool shavings of double ewes and rams. In contrast to the single, animals of a normally folded type had the smallest wool clipping in the original, and the animals with a multi-folded type had the largest shaving for their double peers.

The most correct representation with wool productivity can be obtained by cutting clean fibers, which is the most objective. When comparing the data of the cutting of pure wool with the data of the cuttings in the original, it can be seen that the regularity that existed in single ewes and rams remains unchanged. The advantage was also on the side of normally folded animals, but there was only a significant difference between normal folded and multi-folded animals.

In double ewes of non - folded type, the wool clipping index in a pure fiber was higher than in the other types of double ewes, which exceeded the animals of type "C" and "C +" by 2.9 and 1.0%, respectively. On double rams, animals of the "C +" type had the highest index. Animals of type "C-" were inferior to the latter by 0.01 kg, or by 0.4%

It is known that the size of the wool is determined by the cutting of pure fiber, as well as the percentage of its output from unwashed wool. From the data presented in Table 11, it can be seen that the smallest percentage of the yield of pure wool was multi-folded animals; this is apparently due to the high content of fat in their wool.

It should be noted that the percentage of yield of pure wool in ewes and rams "C" and "C-" was almost the same.

When comparing the percentage yield of pure wool of ewes and rams, it is clear that the former had higher rates in all groups; apparently, this is due to the biological peculiarity of the rams to allocate more fat compared with the bright.

CONCLUSIONS

1. Young sheep of different types of folding have different thickness of skin and different number of hair follicles per unit area of skin. The thickness of the skin of multi-folded animals at the age of 18 months was 3115.6 µm, normal folded - 3056.8 µm and unfixed - 2864.1 µm. The number of all hair follicles per 1 mm^2 of skin, respectively, was 82.9; 80.1 and 65.1 pieces.

2. According to the basic index of wool productivity, wool clipping in clean fiber, single normal-folded animals stand in the first place, and in double animals these indicators are higher for non-folded ones. The percentage of yield of pure wool is greatest in non-folded sheep (54.9 -56.71%) and the lowest in multi-folded (51.64 -55.96%).

3. Physicotechnical properties of sheep wool of different types of folding have their own distinctive features. Non-folded and normally folded animals have longer wool. The true length of the wool on the sides at the age of 13 months in single ewes of the "C-" type was 14.50 cm, type "C" - 14.45 cm and type "C +" - 12.24 cm. The animals of the type "C-" stand in the first place in the strength of wool, this indicator in their topographic areas is equal to: side-7,48, back -6,18, belly -5,1 and thigh -6,91 km. The strength of the sheep's

wool of the type "C", respectively, in the areas were 6.64, 5.56.4.84 and 6.55 cN / tex, and of the type "C +" - 6.12; 5.25; 4.48 and 5.76 cN / tex.

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