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## Features of growth and meat productivity of new factory lines of Saryarka Lambs

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### Abstract

This paper shows the results of studying growth, development, and meat productivity of lambs from the new farm lines of the Zhanaarka intrapedigree type of the Saryarka coarse-wooled fat-tailed breed, which is bred in semidesert and dry steppe regions of the Central Kazakhstan. It has been found that the resulting offsprings of line breeding feature exceptional adaptability to the conditions of year-round pasture management, which contributes to low production cost and high level of profitability.

**Keywords:** Meat and fat production; fat-tailed sheep; factory lines; ontogenesis; selected characteristics; physique; exterior; live weight; carcass weight; slaughter yield; coefficient of meatiness.

### Introduction

The most important branch of the agricultural sector in the Republic of Kazakhstan traditionally is sheep breeding, where fat-tailed sheep is dominating in meat and fat production. This is encouraged by the particularities of the agricultural land in the country, where out of the total area (222.3 million hectares) about 84% is pasture land. On top of that, almost 70% of the area is deserts and semideserts, where modern fat-tailed sheep breeding of the Republic was found, established, and developed [1].

In terms of effective use of these pastures, unlike with other species of farm animals, fat-tailed sheep breeding is the most profitable. They feature extremely high meatiness, as if they had been created by the nature itself to provide such essential products as meat and fat for the human race. One very valuable and sometimes unique biological feature of fat-tailed sheep breeds is their high maturing rate and adaptation to adverse climatic conditions. They have significant reserves of fat in the broad tail, which acts as a spare tank that is filled up in favorable nutritional conditions, i.e., in spring and in autumn, and is consumed during summer droughts and winter frost [2].

In this respect, particular interest is the Saryarka coarse-wooled fat-tailed breed of sheep,

tested in 1999 by the Ministry of Agriculture, which includes two intrapedigree species – the Zhanaarka and the Sarysu. Animals of the first type make the main part (about 90%) of this breed, which played a decisive role in its approximation. They feature white and light-gray color of coarse wool, and in terms of meat and fat productivity they overperform local coarse wool sheep breeds by 8-10% [3].

In case of line breeding, sheep of this breed steadily reproduce their economically useful qualities to offspring, and are used to improve wool quality of local coarse wool sheep. They are characterized by strong physique, a well-developed skeleton, correct body forms, strong limbs with dense hoof horn, which is important for year-round pasture management. Live weight of adult stud rams of the desired specie is 90-110 kg, of dams – 60-65 kg, wool production is 2.8-3.0 and 2.0-2.2 kg, respectively [4].

One of the important factors for improving any breed of farm animals is line breeding and interline crosses. This is the most important form of selective work. The purpose of line breeding is turning properties of individual outstanding stud rams into group properties [5].

Since 2004, at the “Jenis” pedigree farm, stud rams of the Edilbay breed have been used for improving the number of selection features in local sheep, using the method of introductory

crossing. The purpose of this breeding was, naturally, to increase body weight and to improve meat quality through using the gene-pool of a most productive sheep breed in the world with regard to live weight [6].

Subsequently, cross-breeds of the desired type obtained from this breeding were used as breeding material for creating two new lines of the Zhanaarka type of the Saryarka sheep breed.

The purpose of this work was studying phenotypic variability of the main selection features of the Zhanaarka sheep from created new commercial lines.

## Methods

Line No. 2030 was created by introductory breeding (Saryarka × Edilbay) found on 3/8 breed of ram No. 2030 of the Edilbay breed in order to obtain genotypes characterized by high meat and fat productivity and large tucked-up broadtail. The animals are large, have well-developed skeleton, strong physique, high body weight, and increased maturity of youngsters, light-gray colored fleece; in bulk, class of animal's wool is II. By body type they deviate toward the Edilbay sheep, which is one of the original genotypes. The average live weight of line successor rams is 103 kg, in some individual animals it is 117 kg, and wool production is 3.0 kg. In dams, these figures are 68, 80, and 2.2 kg, respectively. Rams and dams live weight is by 14.4 and 3.8% higher than in the breed's standard that has been set for animal of the elite class and wool production is at the level of these requirements.

Line No. 2145 has been created by introductory breeding (Saryarka × Edilbay) found on

1/4 breed of ram No. 2145 of the Edilbay breed in order to obtain genotypes characterized by a favorable combination of high meat and fat productivity and average tucked-up broadtail. The animals are medium-sized, have light skeleton, strong physique, high agility, and good maturity rate of youngsters, only white colored fleece; in bulk, class of animal's wool is I. By body type, sheep of this line deviate toward the maternal base, i.e., Saryarka sheep, which is one of the original genotypes. The average live weight of line successor rams is 97 kg, wool production is 3.5 kg, and 4.0 kg in some individual animals. In dams, these figures are 61, 2.6, and 3.0 kg, respectively. Live weight of rams is by 7.8 higher than in the breed standard set for animals of the elite class, and for dams it is within the level of requirements for animals of the desired type. Wool production is 16.7 and 18.2% higher than the standard requirements for animals of the elite type.

## Discussion and Results

Live weight of fat-tailed sheep is a leading selection sign that most exhaustively reflects organism's growth and development at different stages of ontogenesis. Live weight significantly influences development of many economically useful selection indicators [7].

According to our data (Table 1), live weight of new-born rams in various lines is 4.1-4.7 kg, of ewe-lambs – 3.7-4.2 kg, which shows sufficient lambs development during the uterine growth period. However, certain intergroup differences have been detected. So, live weight of rams in line No. 2030 exceeds that of their age-mates in line No. 2145 by 14.6%, and by 13.5%

**Table 1: Variability of live weight in lambs of different lines (kg).**

Age	Indicators	Line No. 2030		Line No. 2145	
		♂	♀	♂	♀
At birth	n	98	109	106	96
	$\bar{X} \pm m_x$	$4.7 \pm 0.07$	$4.2 \pm 0.03$	$4.1 \pm 0.06$	$3.7 \pm 0.04$
	$C_v$	20.5	18.6	9.3	8.5
4 to 4.5 months	n	72	90	99	93
	$\bar{X} \pm m_x$	$38.0 \pm 0.24$	$35.3 \pm 0.22$	$35.2 \pm 0.21$	$31.5 \pm 0.18$
	$C_v$	15.1	13.7	8.6	6.8

for ewe-lambs, respectively. These figures show that the genotype of parents has influence from the early period of ontogenesis (uterine period).

In the post-uterine period, due to relatively high growth rate, rams of various lines at the age of 4-4.5 months, i.e., at the time of weaning them from dams, reached body weight within 35.2-38.0 kg, while ewe-lambs reached 31.5-35.3 kg. Lambs in line No. 2030 at this age keep the tendency to superiority, which was manifested in the uterine period of ontogenesis. So, rams in line No. 2030 outperform their age-mates in line No. 2145 in terms of live weight by 8.0%, and ewe-lambs – by 12.1%.

It should be noted that the absolute figure of live weight in animals may fail to completely characterize growth intensity and maturity rate; therefore, average daily weight gain was determined (see Figure 1).

In order to assess relative growth rate of lambs with different indicators of live weight in the two lines during the dairy season, we determined their relative growth rate. According to our data, it was found that the average live weight in rams and ewe-lambs during the dairy period increased over 7 times, compared to the weight at birth.

Average daily weight gain during the dairy season ranges from 230 to 280 g. With that, rams in line No. 2030 outperform their age-mates in line No. 2145 by 7.1%, and ewe-lambs – by 11.9%, respectively.

Such a high average daily weight gain in lambs of different genotypes from birth to 4-4.5 months of age, is, first of all, explained by genetically predetermined maturity rate developed during evolution in fat-tailed sheep, high milkiness of ewes, and animals' better adaptation to the

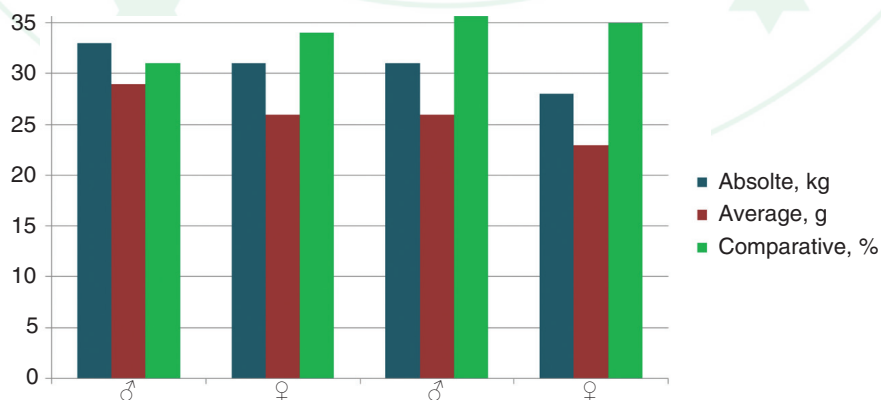
conditions in their breeding areas. Therefore, in meat and fat sheep breeding, the main amount of lamb meat is obtained by selling lambs at the moment of their weaning from dams. This not only ensures high quality of meat products but also reduces their cost, and the latter fact, in turn, increases productivity [8].

Live weight of farm livestock during the postnatal ontogenesis is largely influenced by paratypic factors, i.e., one of them has high "reaction rate" in case of feeding and keeping. In this respect, analysis of the coefficient of variation (CV) of body weight of lambs of various genotypes is of particular interest for practical breeding. In general, during all age periods, the CV in lambs from line No. 2030, unlike their age-mates, is much higher due to direction of breeding by a particular trait.

History of cattle stock breeding development clearly shows that successful breeding is impossible without taking into account exterior features of the physique. It was found that growth and development of organism and its parts in some periods of individual development are not uniform, which causes changes in body proportions, as the animal grows [9].

Based on these circumstances, we also studied lambs' exterior body measurements. Thus, shoulder height of rams from line No. 2030 at birth was 40.2 cm, and of ewe-lambs – 38.0 cm, which increased to 65.2 and 61.1% during the dairy season within 4-4.5 months of age. At the same time, both rams and ewe-lambs of this line by the absolute figures outperform their age-mates from line No. 2145 at birth by 6.1 and 3.3%, at the age of 4 months – by 5.1 and 4.4%, respectively.

**Figure 1: The growth rate of lambs in different lines during the dairy season.**





Side-wise body length of rams and ewe-lambs in this line exceeded indicators of their agetates by 16.2 and 4.5%, respectively, at birth, and by 5.8 and 5.5% at the age of 4-4.5 months. Chest girth of rams and ewe-lambs in this line exceeded indicators of their agetates, respectively, by 1.8-2.9% at birth, and by 1.7 and 1.3% at the age of 4-4.5 months.

Comparison of development of absolute measurements at a particular point of the animals studied does not provide full opportunity to characterize the physique and achieve proportionality in development, as well as physique differences. Therefore, in order to characterize general habitus of Zhanaarka lambs in a more complete and descriptive way, we calculated major indices of the physique (Table 2).

Various intensity of axial and peripheral skeleton bones growth during both uterine and postuterine periods affects body proportions of the growing youngsters. Therefore, some

physique indexes increase with the age of animals, some reduce, and some remain almost unchanged. This is due to the evolution of these animals' development that has adaptive values.

In general, the characteristic of physique index shows that in the body of these lambs, main changes occur during the dairy season, and body proportions are similar to those of adult animals, which fact shows their high maturing rate.

As it is well known, meatiness is closely related to body weight, which, in turn, is due to the degree of tissues growth intensity that ensures meatiness [10]. However, this figure, in isolation from the other objective methods of assessing meat productivity, cannot ensure full and proper understanding of sheep's meat qualities. In this regard, we have slaughtered 4 months old rams from two new farm lines No. 2030 and 2145 of the Jenis stud farm. Results of the check slaughter show that in all groups, standard

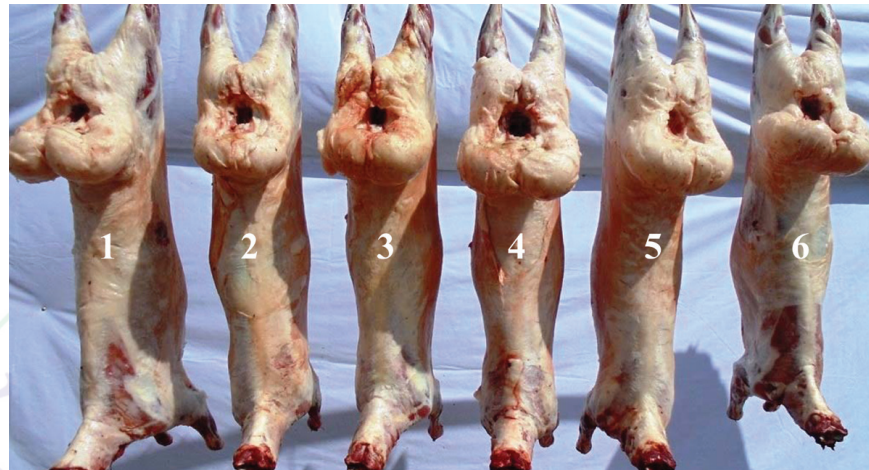
**Table 2: Indices of physique of lambs from various lines.**

Indices	At birth				4-4.5 months			
	Line No. 2030		Line No. 2145		Line No. 2030		Line No. 2145	
	♂	♀	♂	♀	♂	♀	♂	♀
Index of leg height	58	62	60	64	55	61	57	62
Index of lengthiness	97	86	88	85	102	100	100	99
Chest	71	62	66	59	71	60	65	58
Overgrowing	106	104	106	103	102	101	102	100
Compactness	119	113	104	100	120	117	115	114
Boniness	14	14	14	12	9	9	8	9
Hips-and-chest	121	105	114	100	113	101	103	96
Massiveness	106	104	99	99	118	115	114	112

**Table 3: Slaughter indicators of rams from various lines.**

Indicators	Line No. 2030	Line No. 2145
Live weight before slaughtering (kg)	38.7 ± 1.54	36.2 ± 1.49
Carcass weight (kg)	16.1 ± 0.35	14.0 ± 0.23
Yield (%)	41.6	38.7
Weight of broadtail (kg)	3.0 ± 0.09	2.5 ± 0.17
Yield (%)	7.8	6.9
Weight of visceral fat (g)	343.0 ± 0.05	219.3 ± 0.01
Yield (%)	0.9	0.6
Slaughter weight (kg)	19.4 ± 0.31	16.7 ± 0.23
Yield (%)	50.0	46.1
Mass of flesh (kg)	12.8 ± 0.16	11.4 ± 0.10
Yield (%)	79.8	81.5
Weight of bones (kg)	3.3 ± 0.25	2.6 ± 0.09
Yield (%)	20.2	18.5
Coefficient of meatiness	4.0	4.4

**Figure 2: Carcasses of 4 months oil rams with broadtail**  
1-3–line No. 2030, with average weight of 19.1 kg; 4-6–line No. 2145,  
with average weight of 16.7 kg.



carcass weight was obtained from rams of different genotypes. However, along with that, there are certain inter-group variations by key figures (see Table 3).

According to our data, rams from line No. 2030 by their carcass weight outperformed their agemates from line No. 2145 by 15.0%, and in terms of the slaughter weight – by 16.2%. Along with that, there is a marked increase of fat deposition in the broadtail, up to 20.0%.

Study of the muscle to bone ratio in the carcasses of young rams from various genotypes showed that by the morphological composition of carcasses, there are slight variations between the lines compared. With that, rams from line 2145 had a higher coefficient of meatiness (4.4). It should be noted that by the coefficient of meatiness, sheep of the Zhanaarka type are better than other coarse-wooled fat-tailed breeds. This owes to the fact that this breed is characterized by lightweight skeleton, and animals with a more developed skeleton are mainly found among animals from line No. 2030, so ram bones yield in these groups was 1.7% higher compared to their agemates (Figure 2).

## Conclusion

In general, lambs from new sheep farm lines of the Zhanaarka intrapedigree type of the Saryarka coarse-wooled fat-tailed breed feature high enough maturity rate at the age of 4-4.5 months, i.e., at the time of weaning them from the dams

after the dairy period they have enough slaughter weight, 19.4 and 16.7 kg.

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