

The results of cross-breeding in meat-fat-tailed sheep breeding

Tuleukhan Sadykulov, Darkhan Bakytbekovich Smagulov, Sholpan Rahimbekovna Adylkanova, Azamat Mardenovich Koishibaev

Kazakh National Agrarian University, Abai Avenue, 8, Almaty, 050010, The Republic of Kazakhstan

Abstract. In Kazakhstan the fat-tailed sheep breeding is traditionally a leading branch of the animal industries the share of which is about 70% of the total sheep livestock in the Republic. These sheep differ in the exceptionally high meat productivity – as if they were created to provide humanity with food essentials by the nature itself. Their breeding has been predefined by the natural-climatic and economic conditions, as well as by the national traditions of the indigenous population long ago. They are known for its unsurpassed precocity and their adaptation to the specific local, often extreme paratypical conditions of their habitat in some regions where the management of other branches of the agricultural sector is practically impossible.

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Introduction

There are the following breeds among the available 7 fat-tailed sheep breeds of Kazakhstan: 4 breeds with coarse wool of the specialized meat-fat type (Kazakh coarse-woolen, edilbayskaya, saryarka and ordabasynskaya), the remaining combined breeds – the meat-fat-woolen breeds (with semi-coarse wool – Kazakh semi-coarse-woolen, II type degeresskaya), the meat-wool-fat (with semi-fine wool – I type degeresskaya) and fur-meat-fat breeds (Atyrau). It should be added that the last two types are the unique achievements of the scientists genetics-breeders of Kazakhstan. For, both of them are the only breeds of the world's sheep breeding: degeresskaya combining the fat tail with semi-fine wool of cross-bred and cross-bred type, Atyrau – Karakul of original colouring [1].

Currently, the selection of the coarse-wooled fat-tailed sheep of the meat-fat type is mainly focused on the production of high-quality lamb, having demand for lamb with a white and light-grey colouring of the wool in the international market, meeting the requirements of the processing industry. The production of the above products should be carried out at the expense of maximum use of the natural pasture forage what makes this branch of sheep breeding little energy-consuming and increases the efficiency of breeding of these sheep in the conditions of the modern market economy [2].

The systematic use of specific combinations of genetic characteristics of these sheep breeds is a unique opportunity which, of course, must be used for the rapid rise of efficiency of breeding of the fat-tailed sheep. And the availability of such gene pool gives the opportunity to solve both tactical and strategic tasks in the selection of sheep breeding of

the Republic in the long term [3]. The important and most effective solution of the set tasks is the necessity to extensively use different variants of cross-breeding [4, 5].

In this aspect, the saryarka breed with two interbreed types – zhanaarkinsky (SCF-ZH) and saryuskiy, tested by the Ministry of agriculture of the Republic of Kazakhstan in 1999, is of particular interest among the populations of the fat-tailed sheep of Kazakhstan. The share of the first type is the main part (about 90%) of this breed different in the white and light-grey colouring of the wool what played a decisive role in its establishment [6].

The zhanaarkinskiy sheep are characterized by strong constitutions, correct forms of the bodies, strong limbs with the tight hoof horns what is especially important for a year-round grazing system. They have characteristic features in the leading selected signs and firmly pass them to their offsprings. The live weight of the adult stud rams of the desirable type is 90 – 110 kg, ewes – 60-65 kg, wool production – 2.8 and 3.0 and 2.0-2.2 kg accordingly. The breeding of this type of sheep is currently carried out by 3 tribal subjects in the Republic: the stud farm "Zhenis", the breeding farm "Maksat" of the Karaganda and the breeding farm "Ruslan" of the Almaty regions [7].

The long-term analysis of study of the leading selected signs showed that the animals of the stud farm "Zhenis", where the best population of this sheep breed is concentrated, in general, are characterized by the average sizes, lightweight skeletons, small body weights and their extremely low phenotypic variability. The coefficient of variation (Cv) of live weight of the rams and ewes was 8.2% and 5.1% on our data. As it is known, this

factor significantly slows the tempo of the breeding work what noticeably reduces its efficiency [8].

Proceeding from these circumstances, as we've reported earlier, since 2004 the stud rams of edilbayskaya (ED) breed as well as since 2011 of Kazakh coarse-wooled fat-tailed breed of intrabreed type akkarabas (KCAKK) are used to improve a number of the selected signs of the local sheep by introductory crossing type in the stud farm "Zhenis". The latter have exclusively white colouring of the wool except for the covering hair of the head. In the first case, the task of crossing, of course, was the increase of live weight and improvement of meat quality through the use of the gene pool of one of the largest breed in live weight among the reared sheep breeds in the world, in the second case – typification and consolidation of the desirable white colouring of the coarse wool of the zhanaarkinskiy sheep. Used in the experience stud rams of edilbayskaya breed had the live weight on average 102 kg, wool production – 3.3 kg and red colouring of wool, and the stud rams of intrabreed type akkarabas – 100 kg, 3.5 kg and white colouring accordingly.

Methods

The objects of the study were purebred flock of sheep of the saryarka breed (zhanaarkinsky type) and their hybrids obtained by crossing of the saryarka ewes with rams of the edilbayskaya breed (I experiment) and intrabreed type akkarabas (II experiment).

The task of this article was to study the leading economic-useful selected signs of sheep of half-hybrids in comparative aspect with purebred peers in the first and in the second experiment. The experiments were performed in duplicate; the animals were kept in one flock, exclusively in the same paratypical conditions. The experimental ewes and the offsprings received from them were in the conditions of year-round grazing, except for additionally received 2 kg of hay per 1 head per day to pregnant ewes in winter during 50-60 days.

The selection of sheep was conducted in accordance with the instructions on the valuation of sheep of the fat-tailed breeds (Astana, 2000) and also with our developed recommendations for breeding work with sheep of the saryarka breed (Almaty, 2009). The study of productive qualities of the sheep was conducted according to the standard methods of AIB. The live weight of the experimental groups of young animals was studied at birth, at the age of 4-4.5 and 18 months. According to the results of weighing the absolute, average daily and relative gains were determined. At the same time, in the same periods the exterior features by taking the main body measurements and calculation of physique indices

were studied. The analysis of digital materials was performed by the method of variational statistics by N. Plokhinskiy and E. Merkur'eva using a computer program Past (version 2.13).

The main part

The live weight of farm animals has the important economic and biological value, it most fully reflects the process of growth and development of an organism at different stages of ontogenesis. The productivity of sheep, especially their meat characteristic, depends significantly on the amount of the live weight, as in most cases there is positive correlation between these indicators other things being equal [9]. The body weight of lambs at birth indicates on the level of the embryonic development and the potential for their growth in the post-embryonic development period (table 1).

Table 1. Dynamics of the live weight of sheep of different genotypes

Age	Indicators	I experiment				II experiment			
		Lambs		Fwe-lambs		Lambs		Fwe-lambs	
		SCF-ZH x ED	SCF-ZH x SCF-ZH	SCF-ZH x ED	SCF-ZH x SCF-ZH	SCF-ZH x KCAKK	SCF-ZH x SCF-ZH	SCF-ZH x KCAKK	SCF-ZH x SCF-ZH
At birth	n, head	136	137	150	160	414	198	362	201
	\bar{X} ±m, kg	4.8 ±0.11	4.3 ±0.05	4.2 ±0.06	4.0 ±0.09	4.8 ±0.06	4.3 ±0.05	4.1 ±0.03	3.8 ±0.07
	C _v , %	13.3	13.1	15.5	15.2	17.5	10.0	9.7	7.4
4-4.5 months	n, head	134	124	141	141	382	181	348	196
	\bar{X} ±m, kg	40.9 ±0.46	37.4 ±0.48	37.0 ±0.53	34.0 ±0.37	39.4 ±0.42	37.1 ±0.45	34.9 ±0.33	34.0 ±0.39
	C _v , %	8.8	7.7	8.9	7.4	14.7	9.0	14.9	7.0
1.5 year-old	n, head	120	102	135	135	74	30	138	45
	\bar{X} ±m, kg	67.2 ±0.32	63.5 ±0.39	53.8 ±0.34	52.3 ±0.36	65.5 ±0.29	62.7 ±0.42	55.3 ±0.16	54.1 ±0.56
	C _v , %	7.3	6.1	6.8	6.7	12.3	7.6	11.7	6.2

According to our data, the live weight of the newborn lambs of different groups varies from 4.3 to 4.8 kg, of ewe-lambs – 3.8-4.2 kg what indicates on the sufficient development of the lambs in the fetal period. Upon that, there are certain intergroup differences depending on their genotype. In the first experiment the indicators of the crossbred lambs had an advantage over their purebred peers for 0.5 kg or 11.6%, of ewe-lambs – 0.2 kg or 5.0%, in the second one – 0.5 kg or 11.6% and 0.3 kg or 7.9% accordingly.

As a result of relatively high tempo of growth and development for the milk period the live weight of the lambs at the age of 4-4.5 months was 37.4-40.9 kg and 34.0 – 37.0 kg accordingly to the groups in the first experiment, in the second one – 37.1-39.4 kg and 34.0-34.9 kg. Upon that, the crossbred lambs exceeded their purebred peers in 3.5 kg or 9.4% in the first experiment, the ewe-lambs – in 3.0 kg or 8.8%, in the second one – 2.3 kg or 6.2% and 0.9 kg or 2.6% accordingly.

It should be noted that in 1.5 year-old age the tendency of superiority of half crossbred hybrid animals, appeared in the early period of postnatal

ontogenesis, also saves. So, the lambs in the first experiment exceeded their peers in 3.7 kg or 5.8%, the ewe-lambs – in 1.5 kg or 2.9%, in the second one – in 2.8 kg or 4.5% and 1.2 kg or 2.2% accordingly.

It is well known that the live weight of the farm animals as one of the main quantitative characteristics in postnatal ontogenesis is largely influenced by the paratypical factors, that is, it has a high «norm of reaction» on the conditions of feeding and keeping [10]. In this aspect, the analysis of the coefficient of variation of body weight of the different groups of juveniles is of great interest for practical breeding. On the whole, as one would expect, the coefficient of phenotypic variability of the live weight of the crossbred hybrid juveniles compared to the purebred peers is considerably higher, what is explained by the higher heterozygosity on these signs of crossbred hybrid animals.

Such exceptionally high growth of the fat-tailed lambs during the suckling period regardless of genotype should be explained, first of all, by the genetic conditional precocity produced in the process of evolution of the fat-tailed sheep, high milking of ewes and better adaptation of the animals to the conditions of their breeding zone. Later, after the suckling period, as it is known, the growth rate of the lambs is sharply reduced what is explained by the laws of postnatal ontogenesis, as well as the transition of the lambs fully on the grazing food and simultaneously the deterioration of feeding conditions of the autumn-winter season [11]. Therefore, in the meat-fat sheep breeding the bulk of the lamb is produced due to the realization of the lambs at the age of 4-4.5 months, that is, at the time of beating them from the ewes, what gives an opportunity to get not only meat products of high quality but also reduce its expenses, and the latter, in turn, increases the labour productivity.

Table 2. The slaughter indicators of lambs of different genotypes

Indicators	I experiment		II experiment	
	SCF-ZH x ED	SCF-ZH x SCF-ZH	SCF-ZH x KCAKK	SCF-ZH x SCF-ZH
Pre-slaughter live weight, kg	35.0±0.87	32.0±0.99	40.4±0.81	37.2±0.76
Carcass weight, kg	16.0±0.41	14.3±0.50	16.8±0.56	15.5±0.43
Output, %	45.7	44.6	41.6	41.7
Weight of the fat tail, kg	1.5±0.08	1.0±0.07	3.2±0.33	2.5±0.29
Output, %	4.3	3.1	7.9	6.7
Slaughter weight, kg	17.6±0.20	15.4±0.45	20.4±0.58	18.3±0.31
Output, %	50.3	48.2	50.5	49.2
Weight of flesh, kg	12.4±0.27	11.1±0.30	13.8±0.33	12.7±0.12
Output, %	77.5	77.6	82.1	81.9
Weight of bones, kg	3.8±0.05	3.6±0.09	3.0±0.04	2.8±0.02
Output, %	23.8	25.2	17.9	18.1
Coefficient of meatiness	3.3	3.1	4.6	4.5

The meat productivity is closely correlated with the amount of body weight, what in turn, is determined by the degree of intensity of growth of tissues that form meatiness of carcasses [12]. However, this indicator, in isolation from other

objective methods of evaluation of meat productivity, cannot give a full and correct idea of meat qualities of the sheep (table. 2).

The results of the control slaughter show that there are certain inter-group differences in the main indicators. It should be noted that the used stud rams of the edilbayskaya breed and intrabreed type akkarabas made some genetic changes. So, the hybrid lambs significantly exceed their purebred peers in all slaughter indicators in the absolute and relative terms. Upon that, in the first experiment in pre-slaughter of the live weight of 3.0 kg or 9.4%, in the weight of carcasses of 1.7 kg, or 12.1%, slaughter weight of 2.2 kg or 14.3% ($P>0.95$) and there is a noticeable advantage in the localization of fatty deposits in the fat tail to 500.0 g or 50,0%; in the second experiment – 3.2 kg or 8.6%; 1.3 kg or 8.4%; 2.1 kg or 11.5%; 700 g or 28,0%, accordingly.

The evaluation of morphological structure of the carcass is of considerable interest in the study of meat productivity and precocity of animals, only it can give a correct idea of the mass and the ratio of tissues – muscle, fat and bone that form the sheep meatiness [13].

One of the main and objective indicators of the meat qualities of animals is the ratio of flesh and bones in the carcass – the coefficient of meatiness. The value of this indicator largely depends on the breed characteristics, age, fatness and sex of animals [14]. The coefficient of meatiness in our experiments in different groups of animals varies in the range of 3.1-4.6. As it can be seen from the data, the coefficient of meatiness of the half crossbred hybrid lambs in the second experiment is much higher, due to the influence of the rams of the intrabreed type akkarabas which differ in the lightweight skeletal frame as their purebred peers.

The level of wool productivity and its quality are one of the most important criteria determining the tribal and economic value of a particular breed of sheep. The main components of the integrated expression of the components are length, fineness and density of the wool. And it is quite natural that the amount of wool productivity varies depending on the variability of each component [15]. According to our data (table 3), in the first experiment, as one would expect, the slight advantage is observed in the purebred sheep on the level of productivity of wool and in the second one vice versa – the tendency of superiority is observed in the cross-breed hybrid animals. This is explained by the influence of genotypes of the stud rams used in the experiments. In addition, the wool productivity of the sheep and its components are less affected by the influence of paratypical factors than body weight, and it is largely determined by the heredity.

Table 3. The wool shearing of sheep of different genotypes

Indicators	I experiment				II experiment			
	Lambs		Ewes		Lambs		Ewes	
	SCF-ZH x ED	SCF-ZH x ED	SCF-ZH x ED	SCF-ZH x ED	SCF-ZH x KCAKK	SCF-ZH x KCAKK	SCF-ZH x KCAKK	SCF-ZH x KCAKK
n, head	254	226	276	276	276	123	324	137
$\bar{X} \pm m$, kg	2.2 ± 0.19	2.4 ± 0.15	1.6 ± 0.05	1.7 ± 0.11	2.6 ± 0.10	2.3 ± 0.18	2.0 ± 0.07	1.8 ± 0.15
C, %	10.0	10.2	9.1	8.8	15.5	8.9	14.2	9.3

During the experiments the qualitative indicator of the wool productivity was of particular interest to us, especially its colouring. In addition, the stud rams used in the experiments were noticeably different in these signs. It should be noted that the reduction of the unit weight (13.2%) in the flock of sheep of desirable white colouring of the wool when using rams of edilbayskaya breed, was a success to increase by 18.7% by the genetic feature of rams of intrabreed type akkarabas in the second experiment.

Conclusion

The research materials indicate on the expediency of the use of gene pool of sheep of edilbayskaya breed and of intrabreed type akkarabas on the saryarka ewes (zhanaarkinsky type) what allows to get the valuable material in the breeding respect which is a good genetic basis for the further development of this breed in productive and breed qualities.

As a result of crossing it was possible to increase the level and improve the quality of meat and wool productivity of a modern flock of sheep of the stud farm "Zhenis", as well as to increase the degree of variability of the leading selected signs, the latter, in turn, has a great prospect for the practical breeding.

Corresponding Author:

Dr.Sadykulov Tuleukhan
Kazakh National Agrarian University
Abai Avenue, 8, Almaty, 050010, The Republic of Kazakhstan

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