Influence of Intrabreed Type of Ewes on Meat Productivity of the Progeny in Case of Pure Breeding and Crossbreeding

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Abstract

The article shows the results of the reference slaughtering of purebred and crossbred rams obtained from ewes of the Precose breed of various intra-breed types and producers of meat-and-wool early maturing fine-wool and meat-and-fat coarse wool breeds. Superiority of meat productivity of crossbred lambs from ewes of the meat-and-wool type of various crossing options has been revealed. Cross-breeds of meat-and-wool ewes and Romney producers had the yield of first-class lamb meat higher by 0.32%, with the Kuibyshev – by 2.44%, with the Edilbaevsk – by 2.54%, with the Kazakh tail fat – by 2.45%. Some differences have been found in favor of hybrids in terms of thickness of muscle fibers and the "loin eye" area and, therefore, improvement of raw meat quality.

Keywords: meat productivity, intra-breed type, slaughter weight, slaughter yield, varietal evaluation, loin eye area, diameter of the muscle fibers.

INTRODUCTION

In modern conditions, population's demand and increasing food, especially meat, production in our country are of special importance. Currently in the world sheep breeding, their main income is obtained from sales of lamb meat mainly through slaughtering lambs for meat during the year of birth, since the price of lamb meat from lambs in the international market is 2-4 times higher than the price of lamb meat from adult sheep [1].

Here the significant reserve in increasing production of lamb meat is the introduction of the method of industrial sheep cross-breeding [2]. With successful combination of the parent breeds, industrial crossing promotes development of crossbred animals determined by manifestations of the heterosis effect. Heterosis is the result of successful combination of two crossed breeds, due to which the resulting generation acquires valuable properties such as high viability, good feed-efficiency and productivity beyond the original form. Heterosis is in the first place manifested in sheep by intensity of growth and development, maturing rate, feed efficiency and fertility. With that, manifestations of heterosis by the symptoms of growth intensity in crossbred sheep occur at the age of 1.5 years. In our country, however, industrial crossing in sheep breeding is still not fully used, and therefore has not been widely spread. The main reason is underestimation of this huge reserve in lamb meat production. Although today scientific bases have been developed for using certain breeds for various climatic, economic conditions [3, 4, 5, 6, 7, 8, 9, 10].

At the same time, in developing the basics of using various breeds both in crossing and in pure breeding, the intra-breed type of sheep has not been considered. Therefore, the urgent issue in determining efficiency of various methods of breeding is studying the influence of animals' screening with regard to their intra-breed type on sheep meat productivity indicators [11, 12]. In fact, currently the economic efficiency of sheep breeding is mainly determined by the level of lamb meat production, since the production of wool has widely become unprofitable. In many regions of the country, crossing fine-wool sheep with specialized beef breeds [13, 14, 15] was started to improve their meat productivity. That was the reason for performing studies for identifying the most promising variants of screening with regard to the intra-breed type of ewes the Precose breed on the basis of farms in the Michurinsky district of the Tambov region.

METHODS

The scientific and economic experiment in the use on Precose ewes of producers of early-maturing meat and wool fine and medium wool breeds was performed at the Voskhod Integrated Agricultural Production Center, and of meat-and-fat coarse-wool breeds at the Alikhanova's family farm. At each farm, 6 experimental groups of rams were formed. In the first experiment, ewes of the meat-and-wool and wool-and-meat types of the Precose breed were tupped by rams of the meat-and-wool type of breeds Precose, Kuibyshev and Romney. In the second experiment, ewes of similar breed and types were paired with meat-and-wool

type producers of breeds Precose, Edilbaevsk and Kazakh fat-tail. When experimental rams reached 8 months of age, three rams from each experimental group were slaughtered. The slaughter qualities of experimental rams were assessed by the carcass weight, internal and tail fat, slaughter yield and carcass yield, thickness of watering, flesh, bones, and tendons content in the carcass. The pre-slaughter weight was determined by weighing rams with the accuracy of 0.1 kg after fasting for 24-hours. Carcass weight was determined by weighing together with kidneys and perinephric fat, the slaughter weight – by weighing the carcass with internal fat; the slaughter yield was determined as the percentage of slaughter weight to the pre-slaughter weight. The meatiness coefficient was calculated by the ratio of amount of flesh per 1 kg of bones.

The varietal and morphological composition of carcasses was assessed in accordance with GOST R 52843-2007. In determining the varietal composition of carcasses, to the first grade belonged the scapular-spinal, coxal and lumbar junctures, and to the second grade - lean, zeugopodium and shin ones. In assessing the quality of muscle tissue, the area of "loin eye" was measured with a planimeter, and the diameter of muscle fibers – using the histological method. The experimental data were processed using the method of variation statistics.

The results of fattening of experimental rams indicate a higher growth rate of crossbred animals at the first scientific-economic experiment, as evidenced by the data about pre-slaughter weight shown in Table 1.

Analysis of the materials obtained as a result of reference slaughter shows that the maximum carcass weight from crossbred rams with the use of Romney producers is 13.77 kg, which is greater than that of purebred counterparts from ewes of meat-and-wool type by 7.3%, and similar animals from ewes of the wool-and-meat type - by 6.7%. With that, animals in this variant from both types of ewes featured higher amounts of internal fat and, consequently, higher slaughter weight. At the same time, the maximum carcass yield was identified in the rams in the variant with the Kuibyshev breed x meat-and-wool type of Precose breed, but the resulting difference, compared to other variants, was not veracious. By this indicator, in all variants, offspring from ewes of the meat-and-wool type surpassed the analogues of the wool-and-meat type. Similar trend was noted in terms of slaughter yield, too. The maximum amount of flesh in the carcass was for the variant Romney x meat-and-wool type of Precose – 76.48 %, which was higher than in case of purebred counterparts by 1.12%, and analogues of the wool-and-meat type - by 1.25%.

Main part.

Table 1 - Carcass qualities of experimental rams from ewes of various intra-breed types with the use of semi-fine wool producers

Indicators	Breed of producer rams		
	Precose	Kuibyshev	Romney
Precose ewes of the meat-and-wool type			
Pre-slaughter live weight, kg	31.87±1.13	32.43±1.11	33.33±0.85
Carcass weight, kg	12.83±0.37	13.41±0.61	13.77±0.74
Internal fat, kg	0.36±0.04	0.38±0.05	0.41±0.02
Slaughter weight, kg	13.19±0.41	13.79±0.66	14.18±0.76
Carcass yield, %	40.29±0.38	41.34±0.67	41.26±1.19
Slaughter yield, %	41.4±0.35	42.50±0.73	42.5±1.22
Content in the carcass: flesh, kg % bones and tendons, kg %	9.80±0.38 76.36±0.97 3.03±0.08 23.64±0.97	10.32±0.68 76.91±2.36 3.10±0.27 23.09±2.36	10.67±0.68 77.48±1.06 3.17±0.10 23.05±0.53
Meatiness coefficient	3.24±0.17	3.38±0.42	3.36±0.12
Precose ewes of the wool-and-meat type			
Pre-slaughter live weight, kg	28.40±0.72	31.47±1.0	32.20±0.96
Carcass weight, kg	11.30±0.25	12.83±0.47	12.9±0.53
Internal fat, kg	0.30±0.04	0.33±0.04	0.38±0.02
Slaughter weight, kg	11.60±0.28	13.16±0.51	13.28±0.56
Carcass yield, %	39.80±0.61	40.78±0.74	40.04±0.52
Slaughter yield, %	40.86±0.5	41.81±0.48	41.23±0.56
Content in the carcass: flesh, kg % bones and tendons, kg %	8.15±0.09 72.12±1.32 3.15±0.22 27.88±1.31	9.53±0.56 74.29±0.64 3.30±0.14 25.71±0.64	9.83±0.43 76.23±0.71 3.07±0.15 23.77±0.77
Meatiness coefficient	2.60±0.17	2.89±0.1	3.21±0.13

Table 2 - Carcass qualities of experimental rams from ewes of various intra-breed types with the use of coarse wool rams

Indicators	Breed of producer rams		
	Precose	Edilbaevsk	Kazakh fat tail
Precose ewes of the meat-and-wool type			
Pre-slaughter live weight, kg	35.43±0.11	44.70±0.39	42.42±0.39
Carcass weight, kg	14.52±0.05	19.82±0.06	18.26±0.37
Internal fat, kg	0.55±0.02	0.88±0.03	0.72±0.04
Tail fat, kg	-	0.97±0.04	0.77±0.04
Slaughter weight, kg	15.06±0.03	21.67±0.14	19.73±0.32
Carcass yield, %	41.17±0.33	44.34±0.25	43.05±0.37
Slaughter yield, %	41.85±0.85	48.47±0.16	46.47±0.37
Fatness degree, mm	2.97±0.07	3.83±0.12	3.40±0.05
Content in the carcass: flesh, kg	10.31±0.18	15.91±0.12	14.43±0.29
%	71.41±1.01	80.29±0.47	78.69±1.24
bones and tendons, kg	4.21±0.23	3.91±0.09	3.83±0.28
%	28.99±1.49	19.71±0.47	20.98±1.33
Meatiness coefficient	2.46±0.17	4.08±0.12	4.02±0.07
Precose ewes of the wool-and-meat type			
Pre-slaughter live weight, kg	31.67±0.38	39.40±0.85	37.70±0.42
Carcass weight, kg	12.67±0.43	16.70±0.21	15.21±0.27
Internal fat, kg	0.45±0.03	0.70±0.03	0.63±0.04
Tail fat, kg	-	0.76±0.10	0.73±0.03
Slaughter weight, kg	13.12 ±0.46	18.16±0.33	16.57±0.27
Carcass yield, %	40.0±1.18	42.40±0.60	40.37±1.03
Slaughter yield, %	41.40±1.28	46.13±0.56	46.47±0.37
Fatness degree, mm	2.73±0.10	3.57±0.08	3.53±0.10
Content in the carcass: flesh, kg	8.73±0.41	12.88±0.19	11.53±0.07
%	68.87±1.03	77.13±0.20	75.87±1.74
bones and tendons, kg	3.94±0.09	3.82±0.02	3.71±0.31
%	31.13±1.03	22.87±0.20	24.10±1.76
Meatiness coefficient	2.36±0.12	3.38±0.03	3.24±0.25

Table 3 – Weight and yield of junctures, the varietal composition of carcasses of experimental rams from ewes of various types when using semi-fine wool producers

Name of juncture and grade	Breed of producer rams					
	Precose		Kuibyshev		Romney	
	kg	%	kg	%	kg	%
Precose ewes of the meat-and-wool type						
Carcass weight	12.83±0.17	100	13.41±0.61	100	13.77±0.74	100
Scapular	4.95±0.17	38.59	5.10±0.38	38.04	5.26±0.27	38.20
Coxal	4.62±0.13	36.01	4.80±0.14	35.80	4.94±0.24	35.88
Lumbar	1.43±0.02	11.15	1.6±0.06	11.94	1.64±0.06	11.91
Total, 1 grade	11.00±0.27	85.74	11.51±0.57	85.84	11.85±0.57	86.06
Lean	0.39±0.02	3.04	0.47±0.04	3.51	0.44±0.05	3.20
Brachium	0.78±0.05	6.08	0.73±0.03	5.45	0.73±0.07	5.31
Hind shank	0.66±0.03	5.15	0.71±0.04	5.30	0.74±0.06	5.38
Total, 2 grade	1.84±0.1	14.35	1.9±0.9	14.47	1.92±0.18	13.95
Precose ewes of the wool-and-meat type						
Carcass weight	11.30±0.09	100	12.83±0.47	100	12.90±0.53	100
Scapular	4.25±0.09	37.61	4.70±0.31	36.64	4.88±0.20	37.83
Coxal	4.06±0.09	35.93	4.57±0.25	35.62	4.67±0.15	36.21
Lumbar	1.24±0.04	10.98	1.43±0.05	11.15	1.53±0.09	11.86
Total, 1 grade	9.55±0.21	84.52	10.70±0.5	83.40	11.08±0.43	85.90
Lean	0.40±0.01	3.54	0.50±0.01	3.90	0.43±0.04	3.34
Brachium	0.70±0.03	6.20	0.85±0.06	6.63	0.69±0.02	5.35
Hind shank	0.64±0.03	5.67	0.78±0.05	6.08	0.69±0.05	5.35
Total, 2 grade	1.75±0.07	15.49	2.13±0.09	16.61	1.82±0.11	14.11

The results of assessing slaughter qualities of the rams obtained in the second scientific-and-economic experiment are shown in Table 2. The data in Table 2 show that when meat-and-fat coarse-haired rams are used for crossing, the offspring form tail fat, unlike early-maturing meat-and-wool semi-fine wool breeds. The maximum carcass weight was obtained from crossbred rams with the use of the Edilbaevsk breed, and was 19.82 kg. Thiss was more than with purebred counterparts by 36.5%, and more than in the variant with wool-and-meat type ewes - by 18.7%. Due to the higher content of internal and caudal fat, all cross-bred rams had higher slaughter weight and, consequently, higher slaughter yield. The carcass fatness degree was higher in all variants with crossbred rams, compared to purebred animals. With that, higher fatness degree was identified for the offspring from the ewes of the meat-and-wool type. The maximum amount of flesh in the carcass, 80.29%, was observed in the variant with the Edilbaevsk *x* meat-and-wool Precose, and the minimum - in the variant with purebred analogs from ewes of the wool-and-meat type.

The results of the cutting carcasses of rams from the first scientific-economic experiment are shown in Table 3.

The data in Table 3 indicate better development of the scapular, coxal and lumbar junctures, which belong to first grade lamb meat in carcasses of crossbred rams from both meat-and-wool and wool-and-meat Precose ewes. Thus, cross-breeds of meat-and-wool ewes and Romney producers had the yield of first-class lamb meat higher by 0.32%, with the Kuibyshev – by 2.44%. The offspring from wool-and-meat ewes showed a different trend: when Romney producers were used, the difference in favor of cross-breeds amounted to 1.38%, and with the Kuibyshev

breed, the difference in favor of purebred youngs amounted to 1.12%.

As to second grade junctures, better brachium development was observed in purebred progeny from meat-and-wool ewes, and the lean and rear shank – in crossbred rams. In the offspring from wool-and-meat ewes, better development of lean, brachium and rear shank was observed in crossbred rams.

The results of assessing varietal composition of carcasses, the weight and yield of junctures of experimental rams from ewes of various intra-breed types in the second scientific – economic experiment are shown in Table 4.

The data in Table 4 show that in carcasses of crossbred rams from Precose ewes of the meat-and-wool type with producers of the Edilbaevsk breed, the grade 1 meat yield was higher than that in carcasses of purebred counterparts by 0.54%, and in the Kazakh fat, was on the contrary, lower. The weight of the brachium, lean and rear shank in cross-breeds from ewes of this type was higher than that in purebred analogs. The yield of 2 grade lamb meat from the Precose – Edilbaevsk cross-breeds was lower than that from purebred rams by 0.54%, and of the Kazakh fat tail - higher by 0.55%.

One of the indicators that characterize meat quality is its amount per 1 kg of bones, which can be assessed by measuring the area of "loin eye" - the cross-section of the longest muscle in the back (Table 5 and 6).

Table 5 shows that the loin eye area in crossbred rams was higher by 1.4 and 0.79 cm^2, compared to purebred analogs, respectively. Comparison of crossbred rams from the second and the third groups showed superiority of the second group by 0.61 cm^2. Similar trend was noted in the offspring from wool-and-meat ewes, but the difference between the groups was less significant than in the offspring from meat-and-wool ewes.

Table 4 – Weight and yield of junctures, the varietal composition of carcasses from rams from ewes of various types when using coarse wool producer rams

Name of juncture and grade	Breed of producer rams					
	Precose		Edilbaevsk		Kazakh fat tail	
	kg	%	kg	%	kg	%
Precose ewes of the meat-and-wool type						
Carcass weight	14.52±0.05	100	19.82±0.06	100	18.26±0.37	100
Scapular	5.55±0.26	38.23	7.22±0.38	36.45	6.66±0.87	36.47
Coxal	5.29±0.35	36.46	7.59±0.49	38.32	6.93±0.48	37.94
Lumbar	1.61±0.04	11.15	2.34±0.15	11.83	1.98±0.11	10.88
Total, 1 grade	12.45	85.84	17.15	86.38	15.57	85.29
Lean	0.47±0.03	3.24	0.67±0.05	3.40	0.65±0.04	3.57
Brachium	0.85±0.03	5.92	1.10±0.05	5.54	1.06±0.07	5.84
Hind shank	0.72±0.02	5	0.93±0.02	4.71	0.97±0.03	5.3
Total, 2 grade	2.04	14.16	2.7	13.62	2.68	14.71
Precose ewes of the wool-and-meat type						
Carcass weight	12.53±0.4	100	16.7±0.25	100	15.21±0.33	100
Scapular	4.85±0.13	38.71	5.64±0.15	33.78	5.29±0.24	34.78
Coxal	4.02±0.17	32.09	6.4±0.39	38.33	6.06±0.25	39.85
Lumbar	1.31±0.06	10.46	1.97±0.29	11.80	1.25±0.07	8.22
Total, 1 grade	10.18±0.16	81.25	14.0±0.46	83.84	12.6±0.37	82.84
Lean	0.53±0.08	4.23	0.83±0.06	4.97	0.69±0.04	4.54
Brachium	0.95±0.15	7.59	1.03±0.18	6.17	1.02±0.04	6.71
Hind shank	0.87±0.1	6.95	0.83±0.09	4.97	0.90±0.05	5.92
Total, 2 grade	2.35±0.31	18.76	2.7±0.21	16.17	2.61±0.06	17.16

Table 5 – Quality indicators of the muscle tissue in experimental rams (the 1st scientific and economic experiment)

Indicators	Breed of producer rams		
	Precose	Kuibyshev	Romney
Precose ewes of the meat-and-wool type			
Loin eye area, cm^2	13.21±0.20	14.61±0.20	14.00±0.15
Muscle fiber diameter, μm	36.51±0.15	33.81±0.15	33.23±0.13
Precose ewes of the wool-and-meat type			
Loin eye area, cm^2	13.00±0.13	13.90±0.23	13.73±0.13
Muscle fiber diameter, μm	36.01±0.18	32.21±0.15	31.73±0.16

Table 6 – Quality indicators of the muscle tissue in experimental rams (the 2nd scientific and economic experiment)

Indicators	Breed of producer rams		
	Precose	Edilbaevsk	Kazakh fat tail
Precose ewes of the meat-and-wool type			
Loin eye area, cm^2	13.30±0.22	15.03±0.10	14.27±0.16
Muscle fiber diameter, μm	36.93±0.16	34.10±0.15	35.77±0.18
Precose ewes of the wool-and-meat type			
Loin eye area, cm^2	13.10±0.13	14.62±0.17	14.11±0.13
Muscle fiber diameter, μm	36.01±0.15	34.26±0.15	35.94±0.11

Meat tenderness and taste largely depend on the thickness of muscle fibers. The thicker the fibers are, the worse the meat quality is. By the results of studying the analysis of muscle fibers diameter, the opposite trend was observed: in cross-breed animals from ewes of both intra-breed types, muscular fibers were thinner than in purebred analogs. The difference in favor of cross-breeds was 2.7 μm and 3.28 μm for meat-and-wool types, and 3.8 μm and 4.28 μm for wool-and-meat types, respectively.

The results of assessing the muscle tissue of the offspring from Precose ewes of various intra-breed types and coarse meat-and fat producers are shown in Table 6.

Analysis of the data in Table 6 showed that in case of crossing various intra-breed types from ewes of the Precose breed with Edilbaevsk and Kazakh fat-tailed producers, similar trend was preserved as in the case of crossing with producers of early maturing fine-wool breeds. At the same time, the difference between the experimental groups was less significant in terms of diameter of muscle fibers, and more significant in terms of loin eye area.

CONCLUSION

Thus, a conclusion may be made that analysis of the main indicators of meat productivity in rams obtained as a result of pure breeding with Precose ewes of various intra-breed types and crossing them with the producers of meat-and-fine wool, meat-and-fat coarse wool breeds allowed to identify superiority of crossbred calves from meat-and-wool ewes in terms of the studied indicators. This allows us to recommend this type for choosing ewes for cross-breeding. All variants of industrial crossing assessed in the scientific-economic experiments are promising for increasing meat productivity of animals, and may be recommended for economic entities in the area of breeding Precose merino sheep.

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