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Productivity of ewes obtained from crossing Karakul sheep with imported stud rams

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Abstract: The research was conducted in 2023–2024 at the sheep farm of the Peasant Household „Tsurkan Andrey Ivanovich“ on crossbred sheep in two groups of ♀ (♀Karakul 18.75% × ♂Awassi 31.25%) × ♂Assaf 50% upon the second lactation. The study aimed to carry out crossbreeding of local Karakul sheep with imported rams selected for dairy and dairy-meat productivity to increase milk and meat productivity. Milk productivity was evaluated during the first 20 days of lactation, specifically during the suckling and milking periods, as well as overall for the entire lactation. In the first 20 days of 2023, the ewes from the first and second groups produced 32.90 kg and 28.25 kg of milk, respectively. In 2024, the figures were 43.34 kg and 31.50 kg. During the suckling period, milk production in the first group in 2023 was 181.97 kg, and in 2024, it increased to 222.44 kg. In the second group, milk production in 2023 was 156.27 kg, and in 2024, it reached 193.0 kg. After the suckling period, the milking period followed, during which, in 2023, the first group yielded 116.87 kg and the second 111.43 kg of milk. In 2024, these figures increased to 157.98 kg and 167.40 kg, respectively. The average daily milk yield in 2024 was 1731.19 grams for the first group and 1567.60 grams for the second group. The udder volume of the ewes, calculated in 2024, was significantly higher for both groups compared to 2023. The chemical composition indicators of the milk in 2024 were also higher, with the fat and protein yields per kilogram of milk obtained over the entire lactation in 2024 exceeding those in 2023.

Keywords: Ewes; milk production; lactation; chemical composition of milk; udder measurements

INTRODUCTION

In the Republic of Moldova, the coarse-wool sheep include the local population of peltproducing sheep of the “Chushka” type. The average milk yield of the “Chushka” over a 150day lactation period is around 100 kg of milk. The live weight of ewes ranges from 42 to 45 kg, and for breeding rams, it ranges from 55 to 60 kg. The fertility rate of the ewes is between 105 - 107%, but the quality of the pelts is low.

So, when a new breed arrived in the Republic of Moldova, it gained popularity due to its productivity. The high demand for Karakul pelts stimulated sheep breeders to intensively rear

Karakul sheep. By the end of the 19th century, due to the importation of purebred Karakul sheep from Central Asia, the process of crossbreeding local coarse-wooled „Chushka“ sheep with purebred Karakul rams began in the northern regions of our country (Iliev, 1957).

According to the National Program for the development of new sheep breeds and types in the Republic of Moldova, work began in 1978 to develop an interbreed type of Karakul sheep for pelt, meat, and dairy productivity. This was achieved by crossbreeding local “Chushka” type ewes with Karakul stud rams selected from Uzbek stock. By 2005, a new type had been created, combining the valuable qualities of the original breeds:

the high-quality pelts of the Karakul breed with the milk productivity and adaptability to local conditions of „Chushka“ sheep (Buzu, 2003; Liutskanov et al., 2015; Mashner et al., 2016; Evtodienco, 2017). Over the past fifteen years, the demand for Karakul pelts, which had previously generated the main profits, has dropped sharply. Currently, the primary source of economic efficiency is the sale of meat (both live and slaughtered), as well as milk and dairy products such as yogurt, pickled cheese, kashkaval, and albumin curd.

Given this situation, one of the new breeding directions was to cross local Karakul sheep with rams from imported dairy breeds, specifically the Assaf and Awassi. In 2014, rams of these breeds were imported from Bulgarian sheep farms.

The research aimed to carry out crossbreeding of Karakul ewes with rams of imported dairy breeds to increase the productivity of the ewes.

MATERIALS AND METHODS

The studies were conducted on crossbred ewes ♀(♀Karakul 18.75% × ♂Awassi 31.25%) × ♂Assaf 50% obtained from crossing Karakul sheep with rams of the Awassi and Assaf breeds.

On the second or third day after lambing, a selection assessment (bonitation) and weighing of the newborn male and female lambs were carried out in accordance with the instructions (Buzu and Evtodienco, 2022). In the research of milk productivity in two groups of crossbred ewes ♀(♀Karakul 18.75% × ♂Awassi 31.25%) × ♂Assaf 50%, the first lactation was recorded in 2023 and the second in 2024 - during lambing periods, than in order to study the milk yield of ewes from the moment of lambing until the lambs reached 20 days of age, when they consumed only their mother's milk, and the following data were recorded: lambing date, live weight of lambs at birth and at 20 days of age, and average daily weight gain during this period. The absolute weight gain of each lamb was multiplied by the coefficient 5.35, representing the amount of milk required to produce 1 kg of live weight gain.

From lambing to 20 days of age, during the suckling and milking periods, by carrying out control of milk yields in accordance with the methods specified in the Instructions for assessing the morphological qualities of specialized breeds, populations, types and synthetic lines of dairy sheep in the Republic of Moldova (Mashner et al., 2017), the milk productivity of ewes was studied for the full lactation.

During the control milkings, milk samples were collected and analyzed for chemical composition using the Lactosan MCC device.

The development of the mammary gland was studied through measurement methods (Kirikova, 2006):

- udder length: from the rear bulge of the udder to the front edge at the base (measured with calipers);
- udder width: mammary glands above the teats across the udder halves (measured with calipers)
- udder base perimeter: along a horizontal line at the level of the front base of the udder (measured with a tape);
- udder depth: vertically from the abdominal wall to the base of the teats (measured with a tape);
- udder volume: calculated by multiplying the udder surface area (derived from the perimeter) by its depth, expressed in cm³;
- teat length: from the udder base to the tip (measured with calipers);
- teat perimeter: in the front third of the teat (measured with calipers).

Statistical processing of the experimental results to assess the significance of differences included grouping of the data, calculation of the arithmetic mean (M), the standard error (m), and the reliability criterion (Plohinskii, 1978).

RESULTS AND DISCUSSION

In the first group, at 20 days of age, the live weight of lambs in 2024 was higher than in 2023 by 2.09 kg (23.4%; $P \leq 0.05$); at birth, it was also higher by 0.14 kg (2.6%). The weight gain at 20

days was therefore higher by 1.95 kg (31.7%; $P \leq 0.01$), and the average daily gain was 0.10 kg (32.3%) (Table 1).

In the second group, the 2024 values were also higher. The live weight at 20 days in 2024 was higher by 0.42 kg (3.9%) compared to 2023, and the total weight gain was 0.57 kg (10.7%).

Milk yield from the first 20 days after lambing until the first control milking in the first group in 2024 was higher than in 2023 by 30.03 kg (20.1%;

$P \leq 0.001$), and in the second group by 33.68 kg (26.3%; $P \leq 0.05$) (Table 2).

Over the entire suckling period, the same tendency was observed: in 2024, milk yield in the first group was 40.47 kg (22.2%) higher ($P \leq 0.01$), and in the second group, it was 36.73 kg (23.5%) higher ($P \leq 0.05$).

During the milking period, due to drought in both years 2023 and 2024, only four control milkings were carried out, and milk yield for the

Table 1. Live weight over the first 20 days of lactation

Specification		Group 1 (n-9)					
		year 2023			year 2024		
		M±m	σ	Cv,%	M±m	σ	Cv,%
Live weight, kg.	at 20 days	11,55±0,86	2,93	21,4	13,64±0,58*	2,18	17,3
	at birth	5,40±0,61	1,21	22,4	5,54±0,33*	1,24	22,5
Weight gain, kg.	in 20 days	6,15±0,38	0,76	15,4	8,10±0,39**	1,46	30,1
	daily average	0,31±0,02	0,04	15,5	0,41±19,5	73,0	30,0
Specification		Group 2 (n-8)					
		year 2023			year 2024		
Live weight, kg.	at 20 days	10,85±0,79	1,78	7,62	11,27±0,99	3,27	28,2
	at birth	5,53±0,34	0,76	13,8	5,38±0,27	0,90	16,7
Weight gain, kg.	in 20 days	5,32±0,28	0,63	11,9	5,89±0,42	1,39	35,4
	daily average	0,27±0,01	0,03	12,1	0,29±20,9	69,33	35,4

* $P \leq 0,05$ ** $P \leq 0,01$

Table 2. Milk production of sheep in the suckling period, M±m

Specification		Group 1 (n-9)		Group 2 (n-8)	
		2023	2024	2023	2024
In 20 days	milk yield	32,90±8,03	43,34±4,16	28,45±1,50	31,50±3,23
	daily average milk gain, kg.	1,65±0,40	2,17±0,21	1,42±0,08	1,58±0,16
Ist control milking yield	average daily milk yield. kg.	1,66±0,10	1,81±0,10	1,66±0,13	1,81±0,10
Average daily milk yield. kg.		1,66±0,08	1,99±0,68	1,54±0,18	1,70±0,88
Number of days (20 days till the first milking yield controlling)		90	90	83	95
Milk yield (20 days till the first milking yield controlling), kg.		149,07±7,05	179,10±0,17***	127,82±14,4	161,50±0,14*
Milk productivity over suckling period, kg.		181,97±10,3	222,44±0,20**	156,27±21,4	193,00±0,17*

* $P \leq 0,05$ ** $P \leq 0,01$ *** $P \leq 0,001$

milking period was calculated according to the “Instruction for assessing morpho-productive traits of specialized breeds, populations, types, and synthetic lines of dairy sheep in the Republic of Moldova”.

Table 3 presents data on milk production during the milking period and for the entire lactation.

In the milking period, the average daily milk yield in the first group in 2023 was $1,256.44 \pm 94.04$ g, which was 86.14 g higher than in 2024; in the second group, the opposite was observed— $1,240.00 \pm 92.55$ g in 2024, which was 41.71 g higher than in 2023.

The lactation period in 2024, taking into account weather conditions, was on average 23.8% longer than usual. In the first group, the durations were 202.78 days in 2023 and 196.43 days in 2024; in the second group, the durations were 244.78 and 250.0 days, respectively. In both groups, more milk was produced during lactation in 2024 than in 2023, in terms of total yield, which is dependent on the duration of lactation. A comparison of average daily yields confirmed an increase in milk productivity in 2024 compared to 2023, by 95.23 g in the first group and by 59.94 g in the second group.

In the first group, total milk yield per ewe during lactation was 331.74 ± 14.44 kg in 2023 and 423.76 ± 23.89 kg in 2024, with an increase of 92.02 kg (27.7%; $P \leq 0.01$). In the second group, the weights were 296.15 ± 27.34 kg in 2023 and 391.90 ± 24.91 kg in 2024, representing an increase of 95.75 kg (32.3%; $P \leq 0.05$).

During the milking period, milk samples were taken (Table 4) and their chemical composition was studied.

Analysis of the chemical composition of milk (fat, solids-non-fat, lactose, protein, and mineral salts) showed that, in both groups, the 2024 values were higher than those in 2023. In the first group, milk fat content in 2024 was 1.29% higher than in 2023 ($P \leq 0.001$), and in the second group it was 0.78% higher ($P \leq 0.001$). For other parameters, such as solids-non-fat, lactose, and protein, highly significant positive results were also recorded.

Using the data presented in the tables on milk productivity and chemical composition, calculations were carried out based on milk fat and protein yield (Table 5).

In the first group, fat yield in 2024 was 11.63 kg (53.0%) higher than in 2023, protein yield was 3.84 kg higher (29.7%), and the combined fat and protein yield was 15.47 kg higher (44.3%). The fat and protein content per liter of milk is 13.7 g (13.0%). In the second group, the absolute values were slightly lower than in the first group, but in percentage terms they were higher: fat yield 9.49 kg (54.7%), protein yield 3.58 kg (31.0%), and the combined fat and protein yield was 13.07 kg (41.6%). In terms of fat and protein, 1 L of milk, on the contrary, contains 7.4 g (7.0%).

Analysis of the data for the first and second groups over the two years shows a significant ($P \leq 0.05$; $P \leq 0.01$; $P \leq 0.001$) increase in quantitative parameters in both groups. In the first group, udder length increased by 2.86 cm (20.2%; $P \leq$

Table 3. Results of milk production

Indicators	Group 1 (n-9)		Group 2 (n-8)	
	2023	2024	2023	2024
Milk productivity in the milking period, kg.	116,87±8,75	157,98±9,75**	111,43±9,08	167,40±12,50**
Daily average milk production, g.	1256,44±94,04	1170,30±72,18	1198,29±97,65	1240,00±92,55
Lactation period, days	202,78±2,64	244,78±5,42	196,43±2,49	250,00±5,73
Milk production per lactation, kg.	331,74±14,44	423,76±23,89**	296,15±27,34	391,90±24,91*
Average daily milk production, g.	1635,96±73,94	1731,19±94,31	1507,66±139,57	1567,60±84,32

* $P \leq 0,05$ ** $P \leq 0,01$

Table 4. Chemical composition of milk, %

Specification	Group 1 (n-9)					
	year 2023			year 2024		
	M±m	σ	Cv, %	M±m	σ	Cv, %
Fat	6,62±0,12	1,07	16,22	7,91±0,15***	2,37	25,91
SNF	8,27±0,03	0,30	3,67	8,35±0,03**	0,50	5,87
Lactose	3,68±0,05	0,42	11,30	3,75±0,02***	0,22	5,80
Salts	0,60±0,00	0,03	5,38	0,60±0,00	0,03	5,37
Protein	3,90±0,01	0,10	2,51	3,96±0,02***	0,24	5,94
	Group 2 (n-8)					
	year 2023			year 2024		
	M±m	σ	Cv, %	M±m	σ	Cv, %
Fat	6,72±0,17	1,24	18,43	7,50±0,12***	1,76	21,06
SNF	8,22±0,05	0,59	7,01	8,28±0,04	0,33	3,95
Lactose	3,69±0,02	0,26	6,99	3,73±0,03***	0,23	6,19
Salts	0,61±0,00+	0,03	5,69	0,60±0,00	0,04	6,77
Protein	3,86±0,04	0,40	10,22	3,90±0,02***	0,15	3,83

** $P \leq 0,01$ *** $P \leq 0,001$ **Table 5.** Milk fat and protein yield

Specification	Group I (n-9)		Group II (n-8)	
	2023	2024	2023	2024
Fat yield, kg	21,96	33,59	19,90	29,39
Protein yield, kg	12,94	16,78	11,55	15,13
Yield fat + protein, kg	34,90	50,37	31,45	44,52
Yield of fat and protein to 1 l of milk, g	105,2	118,9	106,2	113,6

* $P \leq 0,05$ ** $P \leq 0,01$ **Table 6.** Values of udder measurements in sheep mothers, cm

Measurements	Group 1 (n-9)		Group 2 (n-8)	
	2023	2024	2023	2024
Udder				
Length	14,14±0,50	17,00±0,68**	14,00±0,73	18,50±0,67***
Width	13,22±0,63	17,00±1,37*	14,38±0,57	16,06±0,45*
Depth	19,78±0,77	28,29±1,15***	21,38±0,49	25,22±1,56*
Perimeter	38,33±0,75	46,93±1,51***	38,75±1,27	46,44±1,53**
Volume	3697±433	8176±531***	4304±280	7493±464***
Teats				
Length	3,28±0,28	4,64±0,23	3,25±0,30	4,72±0,38
Perimeter	3,14±0,15	5,33±0,34	3,00±0,20	4,94±0,42

* $P \leq 0,05$ ** $P \leq 0,01$ *** $P \leq 0,001$

0.01), width by 3.78 cm (28.6%; $P \leq 0.05$), depth by 8.51 cm (43.0%; $P \leq 0.001$), and udder perimeter by 8.60 cm (22.4%; $P \leq 0.001$) compared to previous measurements. In terms of udder volume, the differences were even more pronounced. In the first group, the udder volume was smaller compared to the second group by 4,479 cm³, or 2.2 times ($P \leq 0.001$), confirming the hypothesis that with an increase in the number of lactations in dairy sheep, udder volume increases considerably (Table 6).

A comparison of teat measurements shows that, in dairy-type sheep, teat dimensions do not undergo significant changes with age.

In the second group, a similar performance was observed when comparing 2023 and 2024.

Udder length increased by 4.50 cm (32.1%; $P \leq 0.001$), width by 1.68 cm (11.7%; $P \leq 0.05$), depth by 3.84 cm (18.0%; $P \leq 0.05$), and perimeter by 7.69 cm (14.7%; $P \leq 0.01$). The udder volume in the first group was also smaller than in the second by 3,189 cm³, or 1.7 times ($P \leq 0.001$).

CONCLUSIONS

During the suckling period, milk yield in the first group in 2024 was significantly higher by 22.2% ($P \leq 0.01$) compared to 2023, and in the second group by 23.5% ($P \leq 0.05$).

Over the entire lactation, ewes of the first group produced 27.7% more milk in 2023 compared to 2024 ($P \leq 0.01$), while those of the second group produced 32.3% more ($P \leq 0.05$).

In 2024, ewes of the first group showed a 53.0% increase in fat yield, a 29.7% increase in protein yield, and a 44.3% increase in com-

bined fat and protein yield compared to 2023. In the second group, the respective increases were 54.7% for fat, 31.0% for protein, and 7.0% for fat and protein combined.

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