ANALYSIS OF THE QUANTITATIVE AND QUALITATIVE MILK PRODUCTION OF THE R1 SHEEP RESULTING FROM THE CROSSBREEDING OF LOCAL SHEEP FROM THE NORTH-EASTERN AREA OF ROMANIA WITH THE AWASSI BREED

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Abstract

The aim of the present work was to analyze the quantity and quality of milk production at R1 crossbreeds in the first lactation resulting from crossing local sheep from the north-eastern area of the country with Awassi rams. For the determination of total milk production, the control of milk production includes the suckling period of the lambs and the milking period of the ewes. The AT4 method was used during the milking period following the technical specifications recommended by ICAR. During the suckling period, the amount of milk in R1 crossbreds ewes was 57.33 kg and the production of milked milk was 71.54 kg. The average daily milk production of the 4 controls for R1 crossbred ewes was 649.38±37.03 g, with limits between 285 and 1197 g milk. In 180 days of total lactation the milk production obtained in the first lactation of crossbreds R1 sheep was 128.87 kg, being 2% lower than that obtained in Awassi breed sheep. Thus, a significant improvement in the milk production of local sheep can be observed by using this type of crossbreeding.

***Key words**: Awassi breed, crossing, crossbreds, local sheep, milk production*

INTRODUCTION

In our country there is a very large number of small family sheep holdings where the number of animals is very small, which leads to the production of milk and meat intended mainly for own consumption and less for their delivery to the market [1, 2, 3].

These farms have no breeding programs and raise only non-productive local breeds of sheep. They are mainly reared in extensive rearing systems based on long-term, year-round grazing, which is the most economical method of maintenance, and during short stall periods (90-120 days), the sheep are kept in simple shelters, and most of the work is done by hand [4]. As a result, the productivity and economic performance of these animals is lower than that of Western animals [5, 6].

Western European countries are currently focusing on breeding high-performance sheep breeds that can more effectively meet the changing demands of the European market for high-quality sheep products.

Considering the above and the recent interest of sheep breeders to increase production and farm profitability, we set out to cross Awassi rams with Northeastern Romanian sheep to increase milk production. This breed of dairy sheep was imported to our country in the 1980s and proved to be well adapted to the large-scale breeding practices practiced in the north-east of Romania.

The aim of the study was to increase the milk production of indigenous sheep in the north-east of the country, where unregulated breeding activities take place without a pre-

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established breeding schedule, by absorption crosses between Awassi rams and local sheep breeds, with a view to improving productivity in sheep farms.

MATERIAL AND METHOD

Absorption crosses of local ewes with Awassi rams began in autumn 2018, and during 2023 the crossbred R1 ewes were in their first calving. The objective of the research was the evaluation of R1 females in relation to the quantitative and qualitative production of milk in the first lactation.

The working methods used were also adequate for the purpose of determining the total milk production, and the management of the milk production included the lambing period and the weaning period.

The amount of milk during the lactation period was estimated by the method of valorization of the suckled milk of the lamb, respectively by the weight gain achieved, using the transformation coefficient method. Considering the particularities of the nutrition of the infant lambs, the assessment of the amount of milk sucked from the mother sheep was made for 2 periods, namely:

• the breastfeeding period from calving to the age of 28 days - period in which the amount of milk sucked for 1 kg of weight gain is 5.5 liters;

• the nursing period from the age of 28 days of lambs to weaning - respectively at the age of 60 days when the amount of milk sucked for 1 kg of increased weight gain is 4.5 liters.

The amount of milked milk. Performance evaluation for milk production during the milking period was based on the application of successive productive controls (n=4 controls), at intervals of 30 days. At each control interval, the standard method was used, namely AT4 respecting the technical specifications recommended by the International Committee for Animal Recording (ICAR) [7].

The control of milk production during the milking period was carried out by the controllers of A.J.C.O.C "MIORITA MOLDAVIS" Bacău in two sheep holdings, respectively a private holding from Iași county (crossbreed females R1 in their first lactation) and within SCDCOC Secuieni Bacău (batch Awassi breed females, in their first lactation).

The milking of the ewes taken in the study during the control period (n=100 heads; batch 1 - crossbred R1 females at the first lactation = 50 heads; batch 2 - Awassi breed females at the first lactation = 50 heads) was carried out between May and August, thus carrying out a number of 4 official controls.

During the milking period, only 4 checks were carried out during 2023, as the climatic conditions (excessive drought) reduced the milking period of the sheep, they were weaned at the end of August, so that at the beginning of September they were distributed to the mountain. Thus, the milking period was carried out only for a period of 120 days.

Ewes were milked by hand and milk yield from each was determined by weighing the milking cup using a precision electronic scale (±5 g). The data obtained were recorded in a control register and used to calculate milk production during the milking period.

The evaluation of milk production performance obtained from the lactation analysis was based on the application of the conversion factors during the lactation and milking period and exclusively on the application of the alternative management method AT4. Average total milk production was estimated by the Fleishman method.

$$TMY = L_1.\text{int}_1 + \sum_{i=2an}\left(\frac{L_i + L_{i-1}}{2}.\text{int}_i\right) + L_n.14$$

where:

TMY= Milk yield (kg)

L1 = milk yield of the 1st monthly test;

Li = milk yield of the 2th monthly test (i = 1,..., n);

Ln = milk yield of the last test;

int1 = number of days from lambing to 1st monthly test;

inti= number of days between monthly tests (i-1) and i (i = 1,...,n);

n = total number of monthly tests for a specific animal.

To calculate the quantitative production of milk over the entire lactation, the amount of suckled milk and that of expressed milk were added. The duration of lactation was 180 days (60 days suckling period and 120 days milking period).

Milk quality. Milk quality studies were performed only during the milking period. The analysis of milk quality involved the determination of the chemical composition of the main components of milk (15 samples/control/lot), i.e. the dry matter, as well as the content of fat, protein, lactose and mineral salts in the dry matter. The determination of the chemical composition of the milk samples was carried out in the SCDCOC Secuieni Bacău laboratory using a Funke Gerber LactoStar milk analyzer.

Statistical analysis. Results are presented as mean ± standard error of the mean. All statistical parameters (mean, standard deviation, coefficient of variation, and standard error of the mean) were calculated using Microsoft Office Excel 2016, and the significance of differences between means was determined by the t test (Student) and ANOVA analysis of variance [8]. Differences were considered statistically significant at $P<0.05$ and were indicated by specific superscripts.

RESULTS AND DISCUSSION

The assessment of body development in lambs during the lactation period represented a first objective of the research. The body development of the lambs in the first neonatal part is primarily dependent on how the gestation proceeded, with reference to ensuring the nutritional requirements specific to this period for the mother sheep.

Of all the external factors, the milk production of mothers most intensively influences the change in live weight in the first post-partum periods.

In order to correctly assess the dynamics of body development for the breastfeeding period, individual weighings were carried out. In order to evaluate as well as possible the lactogenic capacity of mothers, weighings were also carried out at intermediate ages, respectively at 28 days and at weaning, respectively at 60 days.

Birth weights were assessed by individual weighing of lambs obtained during the 2023 lambing season. The weight of the obtained lambs was measured within the first two hours of lambing, the time interval during which the hair coat has shed and the lambs have entered.

The analysis of live weight at 28 and 60 days, respectively, is very useful not only to allow a correct analysis of the growth rate of the lambs in the first half of the lactation period, but also to determine as accurately as possible the amount of milk consumed of lamb during this period.

The birth weight of the lambs belonging to the R1 crossbreeds was approximately equal to that of the Awassi lambs, being only approx. 5.3% lower (4.12±0.081 versus 4.34±0.074), the differences being insignificant (Table 1).

At the age of 28 days, the body weight of R1 lambs was 2.3% lower than that of Awassi lambs. The live weight determined at the age of 60 days was on average 15.53±0.228 kg in R2 mestizos obtained from backcrossing R1 females crossbreds with rams from the Awassi breed and 17.00±0.237 kg in the Awassi breed, the differences being of 9.4% (insignificant differences, $P>0.05$).

Assessments based on the analysis of the data recorded following the weighing of the lambs at birth, at 28 days and at weaning (60 days) confirmed that the growth rate of the crossbred lambs was similar to that of the Awassi lambs, a fact confirmed by the fact that all weights recorded during the breastfeeding period were not significantly different (no significant difference, $P>0.05$).

Evaluation of quantitative milk production during lactation. Estimates of milk production during the lactation period were made by monitoring the weight of the lambs at calving and day 60 (weaning), and these data were used to calculate the

average amount of milk consumed by the lambs during this period.

This is necessary because in the first part of the nursing period the lambs accumulate body mass especially based on the intake brought by the consumption of mother's milk. The estimation of milk production for the lactation period was made by the method of the coefficients of transformation of the increase made by the lambs into milk. Thus, in order to appreciate the amount of milk consumed by lambs in the first 60 days, it is considered that the lamb needs an amount of milk of 5.5 kg to achieve one kilogram of body weight gain in the period 0-28 days and 4 .5 kg of milk for one kilogram of gain in the period 28-60 days.

The total amount of milk consumed by the lambs during this period was determined after the statistical processing of the values obtained from the control weighing of the lambs (25 lambs/lot) at the end of the weaning period and during breastfeeding.

Table 1 Analysis of body weight evolution in lambs during the lactation period (n=25 heads/lot) (kg)

Specification	Lot of crossbreeds lambs R2				Lot Awassi breed lambs			
	$\bar{X} \pm s_{\bar{X}}$	V%	minimum	maximum	$\bar{X} \pm s_{\bar{X}}$	V%	minimum	maximum
Birth weight	4.12±0.081	13,89	2.90	5,00	4.34±0.074	11.99	3.60	5.30
Weight at 28 days	10.11±0.125	8.70	8.47	12.36	10.76±0.150	9.78	8.30	12.80
SMZ* 0 - 28 days (g)	0.200±0.005	17.17	0.120	0.250	0.214±0.005	16,23	0,137	0,280
Weight at 60 days	15.53±0.228	10.38	12.30	18.90	17.00±0.237	9,84	15,20	20.80
SMZ 28 - 60 days (g)	0.181±0.009	37.12	0.071	0.315	0.187±0.008	30,26	0,099	0.375

*SMZ – average daily increase

From the obtained data (Table 2), it follows that Awassi sheep have a 5.7% higher lactation capacity compared to R1 mixed sheep (60.60±1.143 kg versus 57.33±0.171 kg), the difference being insignificant (P>0.05).

However, R2 lambs had a mean body weight at weaning close to that of Awassi lambs. However, the females of the Awassi breed have a higher lactogenic potential during the first lactation (P>0.05) compared to that of R1 crossbred ewes during the lambs' lactation period.

Table 2 Milk production obtained during the lactation period (60 days) (n=50 female and 25 lambs/lot) (kg)

Genotype	The amount of milk during the suckling period					
	0-28 days		28-60 days		Total suckling period	
	$\bar{X} \pm s_{\bar{X}}$	V %	$\bar{X} \pm s_{\bar{X}}$	V %	$\bar{X} \pm s_{\bar{X}}$	V %
Lot of crossbreeds R1	32.95±0.800	17.17	24.37±1.280	37.12	57.33±1.171	14.45
Awassi lot	35.33±0.811	16.23	25.28±1.082	30.27	60.60±1.143	13.33

NS – non-significant differences (P>0.05); *significant differences (P<0.05); **distinctly significant differences (P<0.01); ***highly significant differences (P<0.001).

The AT4 method was used to estimate total milk production, with four control periods during lactation according to the methodology.

On control days, milk production was measured alternately, i.e. at morning or evening milking. The gravimetric method was used to measure milk production at milking, using an electronic scale and a standard milking cup. The interval between the days of control was established in such a way as to respect the official methodology recommended in the case of the application of the milk production center to sheep.

After the end of the activities specific to the application of the last milk production control for the current year's lactation, the data were subjected to statistical processing. Based on the values obtained, it can be observed that there are no significant differences between the two batches (Table 3).

Table 3 Average daily milk production during the milking periods (4 controls) (n=50 heads/lot) (g)

Specification	R1 lot			Awassi breed lot		Absolute and percentage difference (±;%)	
	n	$\bar{X} \pm s_{\bar{X}}$	V%	$\bar{X} \pm s_{\bar{X}}$	V%	±	%
Control I	50	934.68±37.44	28.32	979.00±27.04	27.04	44.32 ^{NS}	4.74
Control II	50	739.28±37.55	35.92	792.00±31.34	27.98	52.72 ^{NS}	1.07
Control III	50	544.68±37.53	48.72	523.00±24.80	33.53	-21.68 ^{NS}	1.38
Control IV	50	378.88±36.40	67.93	330.80±22.53	48.17	-48.08 ^{NS}	0.87
Average daily production	50	649.38±37.03	40.33	656.20±23.36	25.17	6.82 ^{NS}	1.05

NS – non-significant differences (P>0.05); *significant differences (P<0.05); **distinctly significant differences (P<0.01); ***highly significant differences (P<0.001).

The average daily milk production on the 4 controls for the R1 crossbreds group was 649.38±37.03 g with limits between 378.88 and 934.68 g of milk, and for the Awassi breed group of 656.20±23.36 g with limits between 285.00 and 1,197.05 g of milk. The average level of daily milk production for Awassi breed ewes was about 1.05% higher than that of crossbred R1 ewes (Table 3).

Differences between controls, including average daily milk production during the milking period, were not significant. The average milk production of the four controls from the Awassi group was 1.05% higher than that from the crossbreds R1 female group, the differences being insignificant (P>0.05).

The average level of milk production during the milking period for Awassi ewes was 0.57 kg lower than R1 crossbreds ewes. It can thus be said that the manifestation of the heterosis effect led to an increase in the milk production of crossbred R1 sheep, the productive level being similar to the Awassi breed. Compared to the initial production of Țurcană sheep during the milking period, the milk production of R1 crossbreds ewes in the first lactation during the milking period (120 days) is higher by 17.30 kg, even in the drought conditions manifested during the grazing period from the year 2023 (Table 5).

During the entire lactation period (180 days) the crossbreds R1 females recorded a total milk production of 128.87 kg, which is 2.09% lower than that of the Awassi sheep (131.57 kg) (Table 4).

Table 4 Milk production during the milking period (120 days) and during the lactation period (180 days) (n=50 heads/lot) (kg)

Specification	R1 lot			Awassi breed lot		Absolute and percentage difference (±;%)	
	n	$\bar{X} \pm s_{\bar{x}}$	V%	$\bar{X} \pm s_{\bar{x}}$	V%	±	%
Control I	50	22.43±0.900	28.32	23.50±0.650	19.53	1.07^{NS}	4.77
Control II	50	16.26±0.830	35.92	17.42±0.690	27.98	1.16^{NS}	7.13
Control III	50	15.80.±1.090	48.72	15.17±0.720	33.53	-0.63^{NS}	3.98
Control IV	50	17.05±1.640	67.93	14.89±1.010	48.17	-2.16^{NS}	-12.67
Total of milked milk	50	71.54±4.420	43.73	70.97±2.670	26.56	-0.57^{NS}	0.80
Total milk (suckling + milking)	50	128.87		131.57		2.70	2.09

NS – non-significant differences (P>0.05); *significant differences (P<0.05); **distinctly significant differences (P<0.01); ***highly significant differences (P<0.001).

Table 5 The significance of the differences between genotypes in milked milk production

Lots	Lot Țurcană 54,24 kg	Lot Awassi 70,98 kg
Lot R1 71.54 kg	17.30***	0.56^{NS}
Lot Awassi 70.98 kg	16.74***	-
Lot Țurcană 54.24 kg	-	-

NS – non-significant differences (P>0.05); *significant differences (P<0.05); **distinctly significant differences (P<0.01); ***highly significant differences (P<0.001).

Evaluation of milk quality. The chemical composition of sheep's milk during the milking period is shown in Table 6. These results show that there are no significant differences in the two batches in terms of fat, protein, lactose and mineral salts content, except for the content of dry matter, which is significantly higher in the Awassi breed group.

Overall, the values regarding the chemical composition of the milk recorded in the two batches of sheep fall within the limits quoted in the specialized literature [9, 10].

Table 6 Milk quality (%) (n=15 samples/lot)

Specification	R1 lot		Awassi breed lot		Absolute and percentage difference (±;%)	
	$\bar{X} \pm s_{\bar{x}}$	V%	$\bar{X} \pm s_{\bar{x}}$	V%	±	%
Fat	7.60±0.07	4.61	7.79±0.09	6.04	0.19^{NS}	1.02
Protein	5.28±0.06	5.49	5.52±0.08	7.22	0.24^{NS}	4.54
Lactose	4.43±0.05	5.44	4.68±0.09	9.13	0.25^{NS}	5.64
Mineral salts	0.80±0.01	8.77	0.83±0.01	5.03	0.03^{NS}	3.75
Dry substance	18.11±0.09	2.57	18.82±0.19	5.81	0.71*	3.92

NS – non-significant differences (P>0.05); *significant differences (P<0.05); **distinctly significant differences (P<0.01); ***highly significant differences (P<0.001).

CONCLUSIONS

Following the study on the quantitative and qualitative milk production of the R1 sheep resulting from the crossbreeding of local sheep from the north-eastern area of Romania with the Awassi breed we can conclude:

1. Milked milk production on the 4 controls for the R1 sheep group was 71.54±4.42 g with limits between 28.05.kg

and 138.70 kg, and for the Awassi breed group 70.97±2.67 g with limits between 48.67 kg and 129.65 kg. The differences in the milked milk production between the two batches are insignificant.

2. Compared to the initial milked milk production of Țurcană sheep during the milking period (120 days), the milked milk production of R1 sheep during the first lactation is higher by 17.3 kg, the difference being highly significant (P<0.001).

3. During the entire lactation period (180 days) the R1 sheep recorded a total milk production of 128.87 kg, which is 2.09% lower than that of the Awassi sheep (131.57 kg). As a result, R1 sheep have a lactogenic potential relatively similar to that of Awassi sheep in the 1st lactation, a fact that shows the beneficial influence of using the Awassi breed to improve the milk production of local sheep in the north-eastern area of the country.

4. Regarding milk quality, milk from Awassi breed sheep has a significantly higher dry matter content (P<0.05) compared to that of R1 sheep.

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