

## RESEARCH ON THE LACTOGENIC POTENTIAL IN THE RESULTING F<sub>1</sub> SHEEP FROM THE CROSSING OF LOCAL SHEEP FROM NORTH-EASTERN AREA OF ROMANIA WITH AWASSI RAMS

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### Abstract

*The aim of the present work was to analyze the lactogenic potential in the second lactation of the F<sub>1</sub> crossbreeds resulting from crossing the local sheep from the north-eastern area of the country with Awassi breed rams. To determine the 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 in the milking period following the technical specifications recommended by the ICAR. During the suckling period, the amount of milk in crossbreeds F<sub>1</sub> sheep was 49.72 kg, and the production of milked milk was 95.13 kg. Average daily milk production on the 4 controls for F<sub>1</sub> crossbred ewes was 774.37 ± 9.76 g with limits between 542 and 1006 g milk. The total production of milk obtained in 180 days at the second lactation of crossbreeds F<sub>1</sub> sheep was 144.85 kg, being 3% lower compared to that obtained by purebred Awassi sheep. The results regarding milk production at the second lactation of the F<sub>1</sub> crossbred ewes are very good, so we recommend to breeders the use of crossing local sheep from the north-eastern area of the country with the Awassi breed for a significant improvement in milk production.*

**Key words:** Awassi breed, crossing, latogenic potential, local sheep, milk production.

### INTRODUCTION

In Romania there is a very large number of small family sheep holdings (73% of sheep holdings used an agricultural area of 0-5 ha in 2016 and 63% in 2020), where the number of animals is very small, which it leads to the production of milk and meat intended mainly for own consumption and less for their delivery to the market, hence the subsistence character of these holdings (NIS, 2022).

In these holdings, no improvement program is applied, sheep are raised from non-improved local breeds, which are exploited especially in the extensive exploitation system, based on as economical a maintenance as possible, i.e. by using for a long period of time during a year of grazing, and during the short stable periods (90-120 days) the growth is done in simple shelters, with the vast majority of the work done manually. As a result, the productive and economic performances achieved by these animals are lower compared to those achieved by animals from western European countries.

In these western European countries, emphasis is currently being placed on the breeding of high-performance sheep breeds, which respond more effectively to the ever-changing demands of the European market, for high-quality products obtained from the sheep species (Padeanu & Voia, 2010; Răducuță, 2022).

Taking into account the aforementioned, as well as the interest shown by sheep breeders in the recent period for improving production and implicitly increasing the profitability of these holdings, we proposed to improve milk production by crossing sheep from the north-eastern area of the country with rams from the Awassi breed. This specialized breed of dairy sheep was imported to our country in the 80s and proved to have a good adaptability to the extensive exploitation system practiced in the north-eastern area of Romania (Pascal, 2015; Tafta et al., 1997).

The aim of the work is to increase the milk production of native sheep from the north-eastern area of the country, where the reproductive activity was carried out

uncontrolled, without a pre-established improvement program, by absorbing crosses of sheep from local breeds with purebred rams Awassi to increase productivity in sheep farms.

## MATERIALS AND METHODS

Absorption crosses of local ewes with Awassi rams began in autumn 2018, and during 2022 the F1 crossbred females were in their second calving (Popescu, 2020). The objective of the research was the evaluation of F1 females in relation to the quantitative and qualitative production of milk in the second lactation.

The working method used was suitable for objectives of this kind of research. To determine the total milk production, the control of milk production included the suckling period of the lambs and the milking period of the ewes.

***The amount of milk during the suckling 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 suckling lambs, the assessment of the amount of milk sucked from the mother sheep was made for 2 periods, namely:

- the suckling 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 suckling period from the age of 28 days of lambs to their weaning – respectively at the age of 60 days in which the amount of milk sucked for 1 kg of increased weight gain is 4.5 liters.

***The amount of milk milked.*** 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 (alternative control) respecting the technical specifications recommended by the International Committee for Animal Recording (ICAR).

The control of milk production during the milking period was carried out by the controllers of A.J.C.O "MIORITA MOLDAVIS" Bacău in two sheep holdings, respectively a private holding in Iași county (F1 females in the second lactation) and within

SCDCOC Secuieni Bacău (Awassi females breed in second lactation).

The milking of the ewes taken in the study during the control period (n = 200 heads; batch 1 F1 ewes in the second lactation = 100 heads; batch 2 Awassi breed females in the second lactation = 100 heads) was carried out between May and August, thus carrying out 4 official controls.

During the milking period, only 4 checks were carried out during 2022, 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 mount. Thus, the milking period was carried out only for a period of 120 days.

The ewes were milked by hand, and the amount of milk milked from each ewe was determined using a precision electronic scale ( $\pm 5$  g), by weighing the milking cups. The obtained data were then recorded in the control register and later used to calculate the amount of milk during the milking period.

The performance evaluation for milk production resulting from lactation analysis was based on applying the transformation coefficient in the suckling period and on the milking period exclusively on applying the alternative control method AT4. Estimation of the average total production of milk was carried out using the Fleischmann method (ICAR, 2018).

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

***Milk quality.*** Research on the quality of milk was carried out only during the milking period. For the analysis of milk quality, determinations were made regarding the chemical composition of milk in the main constituents (25 samples/control/lot), respectively dry substance, and within the dry substance the content of fat, protein, lactose and mineral salts. The determination of the chemical composition of the milk samples was carried out in SCDCOC Secuieni Bacău's own laboratory using the Funke Gerber type LactoStar milk analyzer.

**Statistical analysis.** The results obtained are presented as mean values  $\pm$  standard errors of the mean. Microsoft Office Excel 2016 was used to calculate all statistical parameters (mean, standard deviation, coefficient of variation and standard error of the means) and the t-test (Student) to determine the significance of the difference between means (Raducuta et al., 2022). Differences were considered statistically significant at  $P < 0.05$  and indicated by specific superscripts.

## RESULTS AND DISCUSSIONS

**The assessment of body development in lambs during the suckling 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.

Out of all the external factors, mothers' milk production 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 suckling 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.

The assessment of birth weight was determined by the individual weighing of lambs obtained during the lambing season held in 2022. The obtained lambs were weighed after the first 2 hours after lambing, a time interval in which the hair coat was ruffled and the lambs recovered.

The analysis of the live weight at 28 and 60 days respectively is extremely useful not only to be able to correctly analyze the growth intensity of the lambs in the first part of the lactation period, but also to be able to determine as precisely as possible the amount of milk consumed by lambs during this time frame.

The birth weight of the lambs belonging to the F1 crossbreeds was approximately equal to that

of the Awassi breed lambs, being only approx. 1% lower ( $4.41 \pm 0.066$  versus  $4.45 \pm 0.084$ ), 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  $14.37 \pm 0.151$  kg in R1 crossbreeds obtained from backcrossing F1 crossbred females with rams from the Awassi breed and  $14.81 \pm 0.62$  kg in the Awassi breed, the differences being only 3.1% (insignificant differences,  $P > 0.05$ ).

The evaluations based on the analysis of the data recorded on the occasion of weighing the lambs at birth, 28 days and at weaning (60 days), confirm that the rate of growth of the crossbreeds lambs has approached that of the Awassi breed lambs, a fact that is confirmed by the existence of non-significant differences in all weights recorded during the suckling period (non-significant differences,  $P > 0.05$ ).

**Evaluation of quantitative milk production during lactation.** The estimation of the milk production for the suckling period was made by the method of the control weighings of the lambs made at lambing and at 60 days (at weaning), and based on these data the average amount of milk consumed by the lambs was calculated in the respective time interval.

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 gain 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. After the weaning period and based on the statistical processing of the values obtained as a result of the control weighing applied to the suckling (50 heads/lot), the total amount of milk consumed by the lambs during this time interval was determined.

Table 1. Evolution of body weight in lambs during the suckling period (n = 50 heads/lot) (kg)

Specification	Batch of crossbred lambs R1				Batch of Awassi lambs			
	$\bar{X} \pm s_{\bar{x}}$	V%	minimum	maximum	$\bar{X} \pm s_{\bar{x}}$	V%	minimum	maximum
Weight at birth	4.41±0.066	10.57	2.90	5.20	4.45±0.084	13.32	3.20	5.80
Weight at 28 days	8.69±0.091	7.38	7.15	10.00	8.89±0.152	12.08	7.00	11.30
ADG* 0- 28 days	0.153±0.003	15.79	0.088	0.196	0.159±0.004	16.79	0.114	0.225
Weight at 60 days	14.37±0.151	7.42	10.80	16.40	14.81±0.62	7.75	12.75	17.40
ADG 28- 60 days	0.182±0.004	14.51	0.114	0.251	0.185±0.004	16.39	0.128	0.291

\*ADG - average daily gain

The data obtained, highlight the fact that Awassi sheep have a 4.4% higher lactation capacity compared to F1 crossbred sheep (51.91 ± 0.670 kg versus 49.72 ± 0.827 kg), the difference being significant (P <0.05). Worth noting that the R2 lambs had at the time of weaning an average body weight close to that

of the Awassi breed lambs. However, the females of the Awassi breed have a significantly higher lactogenic potential (P<0.05) in the second lactation compared to that of the F1 crossbred sheep during the lambs' lactation period (Table 2).

Table 2. Milk production obtained during suckling period (60 days) (n = 50 females and 50 lambs/lot) (kg)

Genotype	The milk quantity during 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 %
Batch of F1 ewes	23.53±0.525	15.79	26.19±0.537	14.51	49.72±0.827	11.76
Batch of Awassi ewes	24.45±0.581	16.78	27.47±0.636	16.39	51.91±0.670*	9.13

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

To determine the total milk production, the AT4 estimation method was used, performing four controls during lactation according to the methodology. On the control days, the amount of milk milked was determined alternatively, either at the morning milking or at the evening milking.

The method used to determine the amount of milk milked was gravimetric, using the electronic scale and standard milking cups. The

interval between the control days was established in such a way as to comply with the official methodology recommended by ICAR. 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 period (4 checks) (n = 100 ewes/batch) (g)

Specification	Batch of F1 ewes			Batch of Awassi ewes		Absolute and percentage difference (±; %)	
	n	$\bar{X} \pm s_{\bar{x}}$	V%	$\bar{X} \pm s_{\bar{x}}$	V%	±	%
Check I	100	1030.3±17.23	16.72	1065.92±15.83	14.85	35.62 <sup>NS</sup>	3.46
Check II	100	890.8±15.81	17.74	855.06±17.05	19.94	-35.74 <sup>NS</sup>	-4.01
Check III	100	718.15±17.83	24.83	726.94±20.02	27.54	8.79 <sup>NS</sup>	1.22
Check IV	100	458.21±15.49	33.81	499.61±11.71	44.73	41.4 <sup>NS</sup>	9.04
Average daily milk production	100	774.37±9.76	12.60	786.88±0.37	14.87	12.51 <sup>NS</sup>	1.62

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 F1 crossbred group was  $774.37 \pm 9.76$  g with limits between 542.25 and 1006.5 g of milk, and for the Awassi breed group of  $786.88 \pm 0.37$  g with limits between 489.75 and 1127.0 g of milk. The average level of daily milk production for Awassi sheep was about 1.62% higher than that of F1 crossbred sheep.

The differences between the controls are insignificant, including the average daily production during the milking period. The average milk production on the 4 controls for the Awassi ewes batch was 1.67% higher compared to the F1 crossbred females batch, the differences being insignificant ( $P>0.05$ ).

The average level of milk production during the milking period for Awassi ewes was 1.59

kg higher than the F1 crossbred ewes. It can thus be said that the manifestation of the heterosis effect led to an increase in the milk production of the F1 crossbred sheep, the productive level being relatively similar to the Awassi breed. Compared to the initial production of Turcană sheep during the milking period, the milk production of the F1 crossbred ewes in the second lactation during the milking period (120 days) is higher by 44.43 kg (approx. 88%), even under the conditions of drought manifested during the grazing period during 2022.

Over the entire lactation period (180 days) the F1 crossbred females recorded a total milk production of 144.85 kg, which is 2.61% lower than that of the Awassi sheep (148.63 kg)

Table 4. Milk production during the milking period (120 days) and during the lactation period (180 days) (n = 100 heads/batch) (kg)

Specification	Batch of F1 ewes			Batch of Awassi ewes		Absolute and percentage difference ( $\pm$ ; %)	
	n	$\bar{X} \pm s_{\bar{x}}$	V%	$\bar{X} \pm s_{\bar{x}}$	V%	$\pm$	%
Check I	100	$31.94 \pm 0.534$	16.72	$33.04 \pm 0.491$	14.85	$1,10^{NS}$	3,44
Check II	100	$26.72 \pm 0.474$	17.74	$25.65 \pm 0.511$	19.94	$-1,07^{NS}$	-4,00
Check III	100	$22.26 \pm 0.553$	24.83	$22.54 \pm 0.621$	27.54	$0,28^{NS}$	1,26
Check IV	100	$14.20 \pm 0.480$	33.81	$15.49 \pm 0.693$	44.73	$1,29^{NS}$	9,08
Total milking milk	100	$95.13 \pm 1.198$	12.59	$96.72 \pm 9.67$	14.91	$1,59^{NS}$	1,67
Total milk (suckling milk+milking milk)	100	144.85		148.63		3.78	2.61

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 presented in Table 5. Thus, according to these results, it is found that milk obtained from Awassi breed sheep has a very

significantly higher protein content ( $P<0.001$ ), compared with that of F1 sheep. Also, the content of mineral salts and dry matter are significantly higher ( $P<0.05$ ), compared to that of the crossbred F1 sheep (Table 5).

Table 5. Milk quality (%) (n = 25 milk samples/check/batch)

Specification	Batch of F1 ewes		Batch of Awassi ewes		Absolute and percentage difference ( $\pm$ ; %)	
	$\bar{X} \pm s_{\bar{x}}$	V%	$\bar{X} \pm s_{\bar{x}}$	V%	$\pm$	%
Fat	$7.54 \pm 0.22$	14.66	$7.60 \pm 0.11$	7.41	$0.06^{NS}$	0.80
Protein	$5.31 \pm 0.05$	5.01	$5.79 \pm 0.11$	9.35	$0.48^{***}$	9.04
Lactose	$4.38 \pm 0.02$	2.41	$4.55 \pm 0.10$	10.57	$0.17^{NS}$	3.88
Mineral salt	$0.81 \pm 0.02$	12.63	$0.86 \pm 0.01$	4.54	$0.05^*$	6.17
Dry matter	$18.05 \pm 0.23$	6.35	$18.80 \pm 0.26$	6.87	$0.75^*$	4.16
Density ( $g/cm^3$ )	$1.0376 \pm 0.0001$	0.022	$1.0376 \pm 0.0002$	0.022	-	-

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

Regarding the fat and lactose content, the differences between the two analyzed batches are insignificant ( $P>0.05$ ). Also, the milk density is similar in the two batches of sheep. 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 (Tafta, 2008).

## CONCLUSIONS

The females of the Awassi breed have a significantly higher lactogenic potential ( $P<0.05$ ) in the second lactation compared to that of the F1 ewes during the lambs' lactation period;

The average daily milk production on the 4 controls for the F1 ewes group was  $774.37 \pm 9.76$  g with limits between 542.25 and 1006.5 g of milk, and for the Awassi breed group of  $786.88 \pm 0.37$  g with limits between 489.75 and 1127.0 g of milk. The differences in the milking period between the two batches are insignificant. Compared to the initial production of Țurcană sheep during the milking period, the milk production of the F1 crossbred females in the second lactation during the milking period (120 days) is higher by 44.43 kg (approx. 88%).

During the entire lactation period (180 days) the F1 crossbred females recorded a total milk production of 144.85 kg, which is 2.61% lower than that of the Awassi sheep (148.63 kg).

Compared to F1 crossbred sheep, milk from Awassi sheep has significantly higher protein content ( $P<0.001$ ) and significantly higher mineral salts and dry matter content ( $P<0.05$ ). Research on the improvement of local sheep breeds by crossing with the Awassi breed will continue during 2023, especially since the results obtained in 2022 were affected by the drought factor.

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