

INTRODUCTION OF LACAUNE SHEEP IN CROATIAN SHEEP BREEDING

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ABSTRACT

In the world, there is an increasing demand for sheep milk and breeding of dairy breeds of sheep. The aim of this work is to present the production of sheep milk and the state and perspectives of Lacaune sheep breeding in the Republic of Croatia. In the world, EU countries and even in Croatia, the production of sheep milk is constantly increasing, which is evidenced by the growing interest in sheep milk and the breeding of dairy breeds of sheep, including Lacaune sheep. Lacaune sheep are bred in the Republic of Croatia by 10 farmers (2,254 breeding heads) and the number is constantly increasing. In the control of milk production of Lacaune sheep in the 3rd lactation, an average daily milk production of 2 kg was determined, and a total milk production of 400 kg in a lactation of 197 days, with an average of 6.3% fat and 6.0% protein. The production and chemical composition of Lacaune sheep in the Republic of Croatia is very similar if we compare it with available research throughout Europe. The abovementioned indicated the appropriate feeding and rearing of Lacaune sheep, but also their good adaptability. The perspective of Lacaune breeding in the Republic of Croatia is promising, and an increase in their number is expected. In addition to the improvement of feeding and rearing conditions, a higher production of milk will be achieved and the economy of production will increase.

Key words: Lacaune sheep, introduction, The Republic of Croatia, milk production, milk quality.

INTRODUCTION

Farmers are increasingly interested in the production of sheep milk, not only because of its quality, but also because of the significant financial impact which this production brings. The demand for sheep milk and cheese on the market is increasing. Accordingly, the interest of farmers in acquiring and breeding dairy breeds of sheep has increased. The majority of dairy breeds of sheep originate and are reared in the Mediterranean and Black Sea regions of the world, where French Lacaune breed is also included. Interest in this breed has been growing for many years. Due to its high milk yield, as well as suitable meat qualities, it is increasingly in demand and exported from France. Back in 1992, it was officially confirmed that 17 countries had imported Lacaune sheep from France (Barillet et al., 2001). For example, imports of Lacaune sheep to Spain began in 1990, where artificial insemination is carried out along with imports of young breeding stock (at the age of 7 months) and crossbreeding with domestic breeds (Manchego sheep) in order to improve the milk production of domestic sheep breeds (Jimenez et al., 2020). The first imports of Lacaune sheep in Bulgaria began in 2007 (120 ewes and 5 rams), in the Elhovo region, and today there are about 10,000 of them (Panayotov et al., 2018a). In the Republic of Croatia, in recent years, the importation and breeding of Lacaune sheep began, primarily with the aim of milk production, but also to spread its breeding in pure blood (Antunović and Novoselec, 2021).

The aim of this work is to present the production of sheep milk as well as to present the state and perspectives of Lacaune sheep breeding in the Republic of Croatia.

RESULTS AND DISCUSSION

Sheep milk production

In the world, there is an increasing demand for sheep milk, which is mostly processed into different types of high-quality cheeses. Pulina et al. (2018) pointed out that the situation in the dairy sector of small ruminants indicates the possibility of a significant improvement, but also an expected increase in production by 2030 (30-50%). According to FAO data (2022), 1,061,855 t of sheep milk is produced in the world nowadays. Comparing the production of sheep milk in the last ten years, its production has positive trend, as an increase in production by almost 6% was determined during 2020, in contrast to 2010 (Table 1).

Table 1. Sheep milk production in the World, Europe, EU (27) and in the Republic of Croatia from 2010 to 2020 (FAO, 2022), t

Year	Area			
	World	Europe	EU (27)	RH
2010	10029049	3125868	2917098	6137
2011	9854811	3048469	2855263	11200
2012	9823579	3080998	2878421	5732
2013	9881280	3094934	2882405	9200
2014	9991480	3179177	2948136	6100
2015	10057331	3161191	2953765	6300
2016	10205743	3186885	2997104	8300
2017	10485847	3143463	2964276	9100
2018	10364548	3027189	2847626	7000
2019	10617961	3128143	2969138	7000
2020	10618551	3109626	2967554	7000
Trend, %	+ 5.88	- 0.52	+ 1.73	+ 14.06
% in the World	100	29.29	27.95	0.07
% compared to Europe and EU	-	-	95.43	0.23 and 0.24

In the territory of Europe for the mentioned period, a similar, or even slightly lower production of sheep milk was recorded (by 0.52%), while this production in the EU member states (27) increased in the ten-year period by 1.73%. Five European Mediterranean countries (Greece, Spain, Italy, Romania and France) are leaders in the breeding of high-quality milk breeds of sheep, which is also reflected in the scale of sheep milk production in Europe (Table 2). It should be emphasized that the production of sheep milk is significant in European countries, because Greece is the third country in the world in terms of sheep milk production (Table 2). Mostly, traditional dairy sheep farming is represented in semi-intensive, extensive, and sometimes in intensive conditions with relatively lower milk production, where a significant possibility of improvement can be observed. Most of the milk is purchased by the dairy industry and a good part is processed into highly sought after and valuable cheeses (Pecorini, Manchego, Roquerfort, etc.). According to FAO data (2021), 7,000 t of sheep milk was produced in the Republic of Croatia in 2020, which is a significant increase of 14.06% compared to 2010.

Table 2. Sheep milk production in the five leading countries in the world and Europe in 2020 (FAO, 2022)

Number	Country			
	World	Milk yield, t	Europe	Milk yield, t
1	China	1211831	Greece	945430
2	Turkey	1207427	Spain	556250
3	Greece	945430	Italy	481970
4	Syria	705582	Romania	426000
5	Algeria	592293	France	325500
% in production		43.91		87.96

Dairy breed of sheep and milk composition especially lacaune sheep

The most important dairy breeds of sheep in the world are bred in the area of the Mediterranean and the Black Sea, and they are Lacaune sheep, Sardinian sheep, Awasi sheep, Assaf sheep, and the breed with the highest milk production German East Frisian sheep. In most European countries, and especially in the Mediterranean, sheep are considered as dairy animals because milk is their most important product. It is known that the production and quality of milk directly depends on the genotype/breed, but also on paragenetic factors, primarily feeding (Antunović et al., 2012).

Lacaune sheep is a well-known French breed originated by crossing domestic sheep with merino breeds and the English short-haired South down breed aiming for meat production. The name originated from the mountain massif Mont de Lacaune (800 m above sea level) located in the south-eastern part of France. Of the total number of sheep in France, the Lacaune dairy line accounts for around 900,000 heads. The selection of sheep populations with high potential for milk production was carried out through qualitative selection for milk production. Larroque et al. (2021) stated that by carrying out the selection from 1985 on the Lacaune breed of sheep, only the milk yield was included, from 1985 to 1990 the protein content in milk was also included, from 1990 to 2005 the fat content in milk, and since 2005 the number of somatic cells in milk and udder measurements have also been included. In addition to high milk production, the Lacaune also has an emphasis on meat production. Most of the breeding is in the Roquefort areas, better known for the production of cheeses (especially the famous full-fat, hard Roquefort cheese). The Lacaune sheep is of medium size, with a stronger constitution. It has pronounced depth and moderately developed width of the trunk. The body weight of sheep is 55-75 kg, and rams 80-100 kg. The body is lightly covered with white wool, and significant areas of her body is covered with short white hair (belly, legs, face, ears, etc.). Its fleece is composed of short strands, and the yield of wool is 1.5-2.5 kg per sheep, while its quality is of the "B" assortment. At the time of significant demand for wool in the textile industry, Lacaune sheep is poorly exported due to insufficient covering of the body with wool (Mitić, 1984). However, significant selection progress has increased the milk yield of Lacaune sheep, and it has become more and more sought after. For example, Barillet et al. (2001) stated in their study that in the nucleus herds of Lacaune sheep in France, the milk yield of sheep from 80 to 270 l was significantly increased in the period from 1964 to 1998. In a lactation of 180 to 200 days, it gives around 200 l of milk containing 6.5-7.5% milk fat, with the best udders giving more than 400 l of milk (Mioč et al., 2007). The birth weight of lambs is 3.5-4 kg. The fertility of Lacaune sheep is 120-140%. Table 3 shows the results of the production and chemical composition of Lacaune sheep milk in research in the available literature.

Table 3. Production and chemical composition of Lacaune sheep milk in different countries of the World

Country	Lactation length, days	Milk yield, kg	Daily milk yield, kg	Total solid, %	Fat, %	Proteins, %	Lactose, %	Reference
Brazil	-	-	-	-	4.90-7.02	4.23-5.04	4.56-5.04	Brito et al. (2006)
Italy			0.792-0.836					Casamassima et al. (2012)
Brazil	-	153.64	1.67	-	6.86	4.93	4.65	Ticiani et al. (2013)
USA	155.2	194.8	-	-	6.31	5.15	-	Thomas et al. (2014)
France			1.09-1.58	-	6.37-6.94	5.05-5.53	-	Gonzalez-Garsia et al. (2015)
Czech Republic	-	-	0.3-1.6	15.86-22.19	4.56-9.82	4.71-7.43	4.16-5.28	Kuchtik et al. (2017)
Bulgaria	150	213 l (139-298)	-	19.02	7.6	7.09	3.67	Panayotov et al. (2018a)
	-	-	-	18.84	7.21	6.19	4.50	Panayotov et al. (2018b)
Hungary	229	197.72	0.83	-	7.78	5.78	-	Libis-Marta et al., 2021)
Estonia	240	-	0.8-1.8	18.62	7.75	5.74	4.76	Tatar et al. (2021)
Spain	160	181.09	1.07	-	-	-	-	Jimenez et al. (2020)
	-	-	1.65	-	6.81	6.37	4.43	Mehaba et al. (2021)

Comparing the available research conducted with Lacaune sheep in the world, it is evident that there are no significant deviations in the production and chemical composition of milk.

The state and perspectives of lacaune sheep breeding in the republic of Croatia

According to the Unified Register of Sheep on 31st of December 2020, 612,806 sheep are reared in the Republic of Croatia. In the Republic of Croatia, in recent years there has been an increasing interest in sheep milk and breeding of dairy breeds of sheep, including Lacaune sheep. Thus, in year 2020, 2,820,751 kg of sheep milk were purchased in Croatia, which is 6.6% more than in 2019. The amount of purchased milk per supplier increased by 11.00% from 7197 to 7991 kg of sheep milk, but the number of suppliers decreased by around 3.6% from 366 to 353 (HAPIH, 2021).

The breeding program of sheep in the Republic of Croatia is carried out with 18 breeds, 9 native and 9 foreign breeds, including the Lacaune sheep. Lacaune sheep have been reared in the Republic of Croatia recently, primarily for the purpose of milk production, but also to spread its breeding in pure blood. Herdbook Lacaune sheep (2,254, of which 1,597 ewes, 591 rams, 66 rams) are included by only 4.61% in the total number of herdbook sheep in the Republic of Croatia (48,923). Lacaune sheep are bred by 10 breeders. The largest number of Lacaune sheep suitable for breeding are bred in Karlovac (1,106), Virovitica-Podravina (637) and Vukovar-Srijem counties (209). There are smaller Lacaune farms in Bjelovar-Bilogora and Istria counties. The noticeable interest in this breed is confirmed by its increased number in Croatia by 45%, as in 2019, 1,559 heads were bred by 5 breeders, and in 2020, 2,254 heads were bred by 10 breeders (HAPIH, 2021). Data from HAPIH (2021) indicated that in Croatia, during milk production controls in Lacaune sheep in the 3rd lactation, an average daily milk

production of 2 kg was determined, and the total milk production was 400 kg in a lactation of 197 days (where the milking period was 137 days), with an average of 6.3% fat and 6.0% protein (tables 4 and 5).

Lacaune farms in Croatia are organized in the continental part rich in cereals, considering the need for high-quality feed to balance their diet in order to express their genetic potential. According to research by Antunović et al. (2022) conducted in the Republic of Croatia, the average body weight of Lacaune sheep is 60.94 kg, and the height of the withers is 68.05 cm. In a lactation of 180 to 200 days, Lacaune sheep give around 200 l of milk, with the best heads giving more than 400 l of milk (Mioč et al., 2007).

The lambing index and litter size of Lacaune sheep in the Republic of Croatia are 1.4 (HAPIH, 2021). In the performance test of male Lacaune lambs, the birth weight was 2.2 kg, the daily gain was 300 g, and the final body weight was 35.7 kg. In the total number of completed lactations in 2020, the Lacaune sheep participates with 734 lactations out of 2,641 lactations, which is 27.80%. Also, this number has increased significantly in the last five years from 199 in 2016 to 734 lactations in 2020. But the pandemic also affected the lower number of completed lactations (HAPIH, 2021).

Table 4. Milk production in Lacaune breed of sheep (HAPIH, 2021)

Lactation	Number of recorded lactations	Lactation length, days	Suckling period, days	Milking period, days	Milk yield in lactation, kg	Milk yield in suckling period, kg
1	252	189	59	129	371,9	125,7
2	216	168	62	106	362,4	134,7
3	135	197	61	137	399,9	128,7
4	49	200	65	135	397,2	138,5
≥5	82	187	63	125	336,2	116,9
<i>Average</i>		<i>185</i>	<i>61</i>	<i>124</i>	<i>372,0</i>	<i>128,8</i>

Table 5. Milk production in Lacaune breed of sheep during milking period (HAPIH, 2021)

Lactation	Milk yield, kg	Daily milk yield, kg	Fat, %	Fat, kg	Proteins, %	Proteins, kg
1	246.2	2.0	6.0	14.8	6.0	14.7
2	227.7	2.2	6.1	13.8	5.5	12.5
3	271.1	2.0	6.3	17.0	6.0	16.6
4	258.7	2.0	6.3	16.1	6.0	15.7
≥5	219.3	1.8	6.0	13.2	5.9	13.2
<i>Average</i>	<i>243.2</i>	<i>2.0</i>	<i>6.1</i>	<i>14.8</i>	<i>5.8</i>	<i>14.3</i>

The production and chemical composition of Lacaune sheep in the Republic of Croatia is very similar if we compare it with the available research conducted with this breed throughout Europe and the World (Tables, 3, 4 and 5). The abovementioned points to the appropriate feeding and rearing of Lacaune sheep, but also to its good adaptability not only in Croatia, but also in the mentioned research conducted around the world.

The perspective of Lacaune breeding in the Republic of Croatia is promising considering the increased interest of breeders in this breed and the growing demand for sheep milk. It is expected that its number will increase along with the improvement of feeding and accommodation conditions, which will achieve higher milk production and raise the financial performance of farmers.

CONCLUSIONS

In the Republic of Croatia, there is an increasing demand for Lacaune sheep breed due to its high milk yield and good adaptability. Considering this, the perspective of breeding and expanding Lacaune in Croatia is promising.

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