

## STUDY REGARDING THE EFFECT OF CROSSBREEDING WITH SPECIALIZED DAIRY BREEDS ON MILK PRODUCTION FROM CARPATHIAN GOATS

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### Abstract

*The purpose of this study was that to evaluate the differences regarding the milk quantity and the biochemical composition of milk between primiparous goats of Carpathian breed and F1 hybrids of Alpin x Carpathian and Saanen x Carpathian, bred and exploited in the same conditions. The F1 hybrid females of Alpine x Carpathian and Saanen x Carpathian were obtained by artificial insemination of a lot of females of Carpathian breed with seminal material provided from he-goats of Alpine and Saanen pure breed. After weaning, the goats were milked 2 times a day, for 5 months. The control of milk production was done monthly. It was individually weighed the quantity of milked milk in the morning and in the evening. Also, there were taken individual samples of milk for the qualitative analysis. The bio-chemical parameters (fat, protein, lactose) were analysed by ultrasonic method at a Lactoscan analyser standardized for milk. The results shows that the average amount of milked milk of hybrids is significantly increased ( $p < 0.05$ ) compared to the Carpathian breed (2031g, 2033g, vs 1145g). The proportion of fat is significantly higher ( $p < 0.05$ ) at both categories of half-bred besides Carpathians (3.74%, 3.84%, vs 3.69%). In conclusion, the crossbreeding of the Carpathian breed with specialized breeds for the milk production leads to an increase of the productive potential.*

**Key words:** goat, milk, Carpathian, crossbreeds

### INTRODUCTION

The composition and the quantity of the goat milk per lactation are influenced by a large series of factors, out of which the most important are: breed, nutrition, animals' health, breeding conditions and the stage of lactation.

In Romania there are favourable conditions of breeding and exploitation of goats, which value the exploitation of natural pastures. The goats are bred in mixt flocks of sheep-goats, but in the last year more and more specialized goat breeders appear; there are very small effectives (1-9 heads) which assure the household consumption of milk, meat, skins; medium effectives of up to 50 heads mixed with sheep or not and newly there are flocks with more than 100 goats in the commercial specialized farms. The goats effectives are bred especially for their milk

production, bigger than that of sheep, but these obtained productions are generally small and of poor quality.

Nowadays in Romania two breeds of goats are bred: White of Banat breed, resulted from crossbreeding of the local goat with German Nobile breed with a proportion of 5-7% and Carpathian breed, rustic breed that has a total proportion of 80%. There is a high variability of the goats of Carpathian breed, under morphologic aspect (body development, colour, conformation) and productive (production of milk and meat and their quality) and reproductive (sexual precocity, fecundity, prolificacy) [11]. The performances of reproduction and production that are obtained by the local goats are relatively small compared to the improved breeds of Alpine and Saanen. The researches made in Romania and in some East-European countries proved that the local breeds and populations from the field and hill areas can be improved through selection in pure breed or through crossbreeding with performance

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animals from Saanen breed and respectively Alpine breed [3, 5].

So, it is needed to change the attitude about promoting the goat breeding in our country by improving the local breeds Carpathian and forming the selected nucleuses, officially controlled, on which a controlled reproduction to be applied. In European Union Greece has 60% from the effective of goats, followed by Spain, Italy and France. Although the number of goats is not very big, except the country from the Balkan zone, the local goat breeds were improved and produce an average of more than 600 litres of milk/ milked goat, and in some countries, as France, Germany, Switzerland the specialized in milk production, exceed 900 litres of milk/ milked goat [7]. In occidental countries it was imposed the exploitation of goats for the milk production which is transformed in proportion of 97 % in cheese. With the purpose of providing milk for food industry on the whole period of milk, France and England control the reproduction of goats by organizing the mating period in spring and autumn [6].

The main selection criteria, that can be taken into consideration are the milk production associated with its qualitative control and the individual productive performances. These objectives can be reached through the selection of the local material, which presents adaptability and resistance at the environment conditions and applying the crossbreeding through infusion with imported seminal material from breeds with superior morph-productive characteristics [9].

The purpose of this study was that to evaluate the differences regarding the milk quantity and the biochemical composition of milk between primiparous goats of Carpathian breed and hybrids of Alpin x Carpathian and Saanen x Carpathian, bred and exploited in the same conditions.

## MATERIAL AND METHODS

After finishing the calving, in February 2017, there were formed 3 lots of primiparous goats, depending by the breed (table 1). The F1 hybrid females of Alpine x Carpathian and Saanen x Carpathian were obtained by artificial insemination of a lot of females of Carpathian breed with seminal material provided from he-goats of Alpine and Saanen pure breed. The males from French Alpine and Saanen breeds were previously analysed for determining the genotypes regarding alpha locus of casein (CSN1S1). The males that contain A and B alleles (strong expression of 3.6 g alpha S1 casein / litre of milk / allele) were gathered [1].

The kids were weaned at 45 days from birth. In the first 45 days from birth, the milk was totally sucked by the kids. After weaning (beginning of April), the goats were milked 2 times a day, for 5 months. The control of milk production was done monthly, on the whole lactation period, starting in April. For this, it was individually weighed the quantity of milked milk in the morning and in the evening. Also, there were taken individual samples of milk for the qualitative analysis. The bio-chemical parameters (fat, protein, lactose) were analysed by ultrasonic method at a Lactoscan analyser standardized for milk. Results were statistically analyzed by SPPS program.

Since April the animals were taken to pasture and received Lucerne hay and chopping of corn and barley as supplement. They had free access (09:00-17:00) on a permanent pasture made of 30% leguminous plants (*Trifolium repens*, *Trifolium pratense*, *Medicago falcata*) and 70% grain plants (*Festuca vallesiaca*, *Lolium perenne*, *Bathriochloa ischaemum*, *Stipa capilata*, *Poa bulbosa*, *Agropyron repens*, *Poligonum aviculare*, *Taraxacum officinalis*, *Dactylis glomerata*).

Table 1 Lots of females subject to experiment

Breed	No. of females	Average weight $\pm$ sx (Kg)
Carpathian	50	37.75 $\pm$ 0.65
Half-bred of French Alpine x Carpathian	40	40.05 $\pm$ 0.63
Half-bred of Saanen x Carpathian	43	42.73 $\pm$ 0.77

## RESULTS AND DISCUSSIONS

On the basis of the nutritive values of the alimentary components there were established the fodder ratios for the females, depending on weight and the level of lactation. All animals received the same portion of pasture and Lucerne hay, the difference consisting in the quantity of corn and barley.

The studies proved that the milk production cannot be improved through nutrition if productivity of the animal is limited by the genetic potential [7]. So, for the lot of Carpathian, whose average weight in the beginning of the experiment was of 37.75 Kg, and the production that is specific to the breed without supplementary foddering (exclusively grazing) is of 0.7-1.2 Kg milked milk [11] received a supplement of 0.2 Kg corn and 0.115 Kg barley. The ratio was calculated for a production of milked milk of 1.5 Kg/day. For the lots of half-bred females, which have an increased genetic potential as a result of half-breeding with breeds that are specialized for the milk production, the milk quantity was estimated at 2.5 Kg milked milk a day, and the supplementary ratio consisted in 0.5 Kg corn and 0.3 Kg barley a day.

The results regarding the quantity and quality of the females from Carpathian breed are presented in table 2. The supplement of chopping of corn and barley increases the quantity of swallowed energy. It is noted an insignificant increase of the quantity of milked milk in the second month of lactation besides the first month, from 1.2 Kg milk/day to 1.3 Kg milk/day, an increase which is also associated to the decrease of fat and protein proportion.

The content in fat of the goat milk is one of the most important technological, nutritional and dietetic parameters of the goat milk. The content in fat of the goat milk is immediately increased after parturition, and then it decreases in the next months. This fact occurs due to two phenomena: an effect of dilution, due to the increase of the milk volume until the top of lactation and an effect of decrease of the mobilization of the lipids fact that leads to the decrease the plasmatic level of non-esterified fat acids, especially C18:0 and C18:1, necessary to the lipids synthesis at the level of mammal gland [4]. Starting with the third month of lactation the average quantity of milked milk/day starts to decrease. Also, the per cent of fat and protein remain relatively constant during June-July and they increase to the end of lactation.

Table 2 Variation of the milk quantity (g) and of composition (%) during lactation at the primiparous females of Carpathian breed

Period of lactation	Quantity of milked milk (g)			Fat (%)			Protein (%)			Lactose (%)		
	mean	sx	CV	mean	sx	CV	mean	sx	CV	mean	sx	CV
Month 1	1234.75	54.547	19.76	3.68	0.022	2.73	3.17	0.010	1.45	4.59	0.018	1.73
Month 2	1345.05	56.278	18.71	3.63	0.025	2.27	3.13	0.016	3.06	4.58	0.017	1.67
Month 3	1275.30	36.708	12.87	3.68	0.022	2.64	3.17	0.009	1.21	4.60	0.016	1.58
Month 4	1014.05	24.121	10.64	3.69	0.022	2.67	3.18	0.009	1.22	4.60	0.016	1.52
Month 5	856.45	54.108	28.25	3.76	0.029	3.42	3.21	0.021	2.97	4.59	0.017	1.68

For the half-bred goats of French Alpine x Carpathian it is noted an increase of the milk quantity starting with the second month of lactation, when the maximum was reached. The experimental data proved that both the half-bred French Alpine x

Carpathian (table 3), and also those of Saanen x Carpathian (table 4) reach the prediction value at the establishment of the ratio, of 2 Kg milk/day, starting with the second day of lactation.

Table 3 Variation of the milk quantity (g) and of composition (%) during lactation at the primiparous females of the hybrids of Alpine x Carpathian

Period of lactation	Quantity of milked milk (g)			Fat (%)			Protein (%)			Lactose (%)		
	mean	sx	CV	mean	sx	CV	mean	sx	CV	mean	sx	CV
Month 1	1957.45	30.133	6.88	3,84	0.028	3.30	3,22	0.011	1.59	4,61	0.01	0.93
Month 2	2178.35	52.955	10.87	3,76	0.022	2.66	3,18	0.006	0.81	4,60	0.044	0.96
Month 3	2173.50	33.578	6.91	3,81	0.027	3.21	3,19	0.007	0.92	4,61	0.01	0.95
Month 4	2010.10	31.812	7.08	3,87	0.027	3.07	3,20	0.006	0.89	4,62	0.01	0.94
Month 5	1840.15	61.159	14.86	3,84	0.028	3.21	3,18	0.008	1.15	4,61	0.009	0.88

Table 4 Variation of the milk quantity (g) and of composition (%) during lactation at the primiparous hybrid females of Saanen x Carpathian

Period of lactation	Quantity of milked milk (g)			Fat (%)			Protein (%)			Lactose (%)		
	Mean	sx	CV	mean	sx	CV	mean	sx	CV	mean	sx	CV
Month 1	2048.45	30.931	6.75	3,73	0.022	2.69	3,20	0.011	1.52	4,65	0.012	1.12
Month 2	2269.15	35.176	6.93	3,68	0.017	2.08	3,18	0.010	1.43	4,63	0.011	1.05
Month 3	2126.25	39.748	8.36	3,72	0.022	2.65	3,21	0.007	1.02	4,63	0.010	1.01
Month 4	1909.65	53.438	12.51	3,74	0.027	3.17	3,23	0.008	1.17	4,64	0.011	1.10
Month 5	1815.1	60.891	15.00	3,72	0.022	2.68	3,22	0.009	1.22	4,65	0.012	1.19

The average amount of milked milk compared to the Carpathian breed (2031g, 2033 g, vs 1145g) (table 5). hybrids is significantly increased ( $p < 0.05$ )

Table 5 Average quantity of milked milk (g) at the prim pare females depending on breed

	F1 Alpine x Carpathian	F1 Saanen x Carpathian	Carpathian
Mean	2031.98 <sup>a</sup>	2033.72 <sup>b</sup>	1145.12 <sup>ab</sup>
Std. Deviation	145.24	178.46	203.38

The various superscript letters (a, b, ab) in the columns show significant differences ( $p < 0.05$ )

The differences regarding the content in protein there are significant differences between the Saanen x Carpathian hybrids and the Carpathian breed (table 6).

Table 6 Average concentration of protein (%) at the prim pare females depending on breed

	Minimum	Maximum	Mean	Std. Deviation
Alpine x Carpathian Hybrids	3.18	3.22	3.1964	0.016
Saanen x Carpathian Hybrids	3.18	3.23	3.2083 <sup>a</sup>	0.017
Carpathian	3.13	3.21	3.1706 <sup>a</sup>	0.031

The various superscript letters (a, b, ab) in the columns show significant differences ( $p < 0.05$ )

The proportion of fat is significantly higher ( $p < 0.05$ ) at both categories of half-bred besides Carpathians (table 7).

In general, the milk that comes from the animals which are exploited on pastures that have an adequate nutritional quality, is characterized by a high content in fats, due to

fodders rich in fibres [7]. Moreover, the studies proved that this kind of milk is also rich in micro-components (fat acids, vitamins), in us volatile composes and phenolic composes, beneficial for the human health and nutrition. The positive effect of grazing upon the fat in milk was also

reported by other authors. In a study developed on goats of Alpine breed, Soryal and col. [10], registered higher proportion of the fat at the goats that had been bred on pasture comparatively to those kept on stable and fed with Lucerne hay.

Table 7 Average concentration of fat (%) at the primiparous females depending on breed

	Minimum	Maximum	Mean	Std. Deviation
Alpine x Carpathian Hybrids	3.76	3.93	3.8444 <sup>a</sup>	0.063
Saanen x Carpathian Hybrids	3.68	3.84	3.7439 <sup>b</sup>	0.060
Carpathian	3.63	3.79	3.6932 <sup>ab</sup>	0.060

The various superscript letters (a, b, ab) in the columns indicates significant differences ( $p < 0.05$ )

The significant increase of the proteins and fats from the milk of the hybrids can be due to the genotyping of the males from which the seminal material was taken for the artificial insemination. There were selected the males that contain the alleles with strong expression (A, B), that determines in milk a possible maximum of alpha casein S1 coagulant of 7.2 g / litre at the homozygote individuals (AA, BB) and AB heterozygote. These different levels of expression of the alpha alleles S1 casein, caused by mutations, explain the differences regarding the quality of milk regarding the content of total protein, coagulating casein and implicit the output of getting the cheese products [1].

The lactose is the main glucid from milk, being synthesized in the mammary gland from glucose. It is an important nutrient because it helps the intestinal absorption of calcium, magnesium, phosphor and use of D vitamin. It also, it has a great importance to maintain the osmotic equilibrium between the sanguine flux and alveolar cells from mammary gland. The lactose is found in a smaller quantity in the beginning of lactation and in the end of lactation [8]. The same variation was registered in our study too, at all the lots of females. There were not registered significant differences between breeds (table 8).

Table 8 The average concentration of lactose (%) at the prim pare females depending on breed

	Minimum	Maximum	Mean	Std. Deviation
Alpine x Carpathian hybrids	4.60	4.62	4.6099	0.007
Saanen x Carpathian hybrids	4.63	4.65	4.6418	0.010
Carpathian	4.58	4.60	4.5921	0.005

## CONCLUSION

Quantity of milk is influenced by hybridisation and by the level of foddering.

The hybridization of the Carpathian breed with specialized breeds for the milk production leads to an increase of the productive potential.

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