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# LIFETIME PRODUCTION OF SLOVENIAN LOCAL GOAT BREEDS

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## SUMMARY

*The objective of the study was to analyze lifetime production data for two Slovenian locally adapted dairy breeds: Slovenian Saanen goat (334) and Slovenian Alpine goat (1105) and for the dairy type of Dreznica goat (141) which is the only Slovenian autochthonous goat breed. Dataset included records from 54 farms. Data for does born after 2002 have been obtained from the database of the National selection program for small ruminants, collected by the ICAR standards. The contribution of farm to phenotypic variance was estimated. Data was analyzed by MIXED procedure in SAS/STAT. The results showed significant effect of breed, farm and year of culling on all traits studied, except the effect of breed on completed lactations in lifetime and number of liveborn kids. The lifetime milk yield was higher in Slovenian Alpine goat compared to Slovenian Saanen goat by  $413.26 \pm 172.52$  kg. The difference in lifetime protein yield between Slovenian Alpine goat and Slovenian Saanen goat amounted to  $11.76 \pm 5.21$  kg. Dreznica goat did not differ in lifetime milk production and protein yield compared to both intensive goat breeds. Dreznica goat yielded about  $25.50 \pm 5.21$  kg more fat in lifetime compared to Slovenian Saanen goat. However, compared to Slovenian Alpine goat the difference was not significant. Comparison of Slovenian Saanen goat and Slovenian Alpine goat revealed higher lifetime fat yield of Slovenian Alpine goat by  $13.28 \pm 5.21$  kg. The results suggested reasonably good performance and adaptation of the autochthonous breed Dreznica goat in local agro climatic conditions.*

**Key-words:** Slovenian Saanen goat, Slovenian Alpine Goat, Dreznica goat, lifetime production, milk yield

## INTRODUCTION

Over the last few years, small ruminants breeding in Slovenia have become more important due to the extensive farming on grassland and pastures. The number of goats has been on the rise since the start of the nineties and up to 2009 when the total number was the largest - 29.896 goats (Statistical Office RS, 2014). Currently, there are about 22,000 goats kept on approximately 3,000 farms in total.

Three local dairy goat breeds are mainly used in Slovenia: the locally adapted Slovenian Alpine goat (the number of the purebred does is around 4,000) which is the most numerous dairy breed in the country and the locally adapted Slovenian Saanen goat with the number of the purebred does around 2,500 (Register of breeds with zootechnical assessment, 2014). Both dairy breeds are widespread throughout the whole territory of Slovenia and they are considered endangered according to their reproduction capacity, population trend and

pure-breeding proportion. The third dairy goat breed is the only Slovenian autochthonous goat breed named Dreznica goat. This breed is the least numerous goat breed in Slovenia. It is composed of about 650 heads and listed as a critical breed due to the concentration of a major part (90%) of the total population in a restricted geographical area, which means within a radius of less than 30 km (Žan Lotric et al., 2013).

The population of Dreznica goat is divided into two types by the purpose of breeding and its original location. Dairy type of Dreznica goat was developed in Bovec area where cheesemaking tradition dates back to the 13<sup>th</sup> century, whereas meat type of Dreznica goat has developed in Dreznica region. Flocks of goats for meat productions are prevailing. Dreznica goat is a seasonal extensive breed, well adapted to the harsh Alpine

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conditions and it is kept also for landscape management in these regions. All does of the Slovenian local goat breeds are seasonally fertile and kid once per year.

In Slovenia goat milk does not have such economic importance and long tradition as it has in other European (e.g. Mediterranean) countries. However, there are some farms where goat milk producing is important. Although the economics of goat milk production is not on a high level, the demand for goat milk and dairy goat products is constantly rising and is recently greater than the supply. The main source of income in Slovenian local goat breeds, beside milk, is cheese, produced by farmers themselves. There are also two by-products known as ricotta and whey. Most dairy products are sold directly at home, as well as at the high and mountain pastures (in the case of dairy type Dreznica goat breed) where goats graze in the summer. There is unfortunately no information about the lifetime production of milk recorded Slovenian local goat breeds provided in the literature. To the best of our knowledge, very few studies about goat milk of Slovenian local goat breeds are available. Kompan and Kastelic (2009) reported how conventional and organic farming system affected productivity of Slovenian Alpine goat, while Žan Lotrič et al. (2006) reported how different altitude of mountain and highland pasture influences milk fatty acid composition of Slovenian locally adapted goat breeds.

Lifetime performance of a doe is the ultimate indicator of its utility in the flock and it is also important in investigating flock economics (Osman et al., 2010). Economic efficiency is mostly a result of achieved milk production and longevity (Heins et al., 2012; Martens and Bange, 2013). The aim of the study was to compare the lifetime production between three goat breeds in Slovenia and to estimate the contribution of flock to phenotypic variance.

## MATERIAL AND METHODS

The production data of Slovenian Alpine breed, Slovenian Saanen breed and Dreznica breed, born between 2002 and 2015 and culled after the 2008, were used for the analysis of lifetime production. The data were obtained from the Slovenian national breeding program for small ruminants recording, collected by the ICAR standards (ICAR, 2014).

The dataset included 1,580 does kept on 54 farms, where the majority of records (1,105) were collected in Slovenian Alpine breed, the most important dairy goat breed in Slovenia. The number of records was considerably smaller in Slovenian Saanen breed (334) and Dreznica breed (141). Extensive farming, highly dependent on grazing, is mostly practiced on all farms that keep autochthonous Dreznica goat whereas most of Slovenian farms breed Slovenian Alpine and Slovenian Saanen goats in a more intensive production system.

The production traits were considered as follows: milk yield, fat yield, protein yield, number of completed

lactations and number of liveborn kids. The lifetime production of the total milk, fat, and protein yield, number of liveborn kids in lifetime was calculated as the sum of production from the first to the last kidding.

The average milk yield in lifetime of all three breeds together was 1534.15 kg ( $\sigma=1230.15$ ) with 49.51kg ( $\sigma=40.19$ ) average fat yield and 46.47kg ( $\sigma=37.39$ ) average protein yield (Table 1). Average age at culling was 72.12 months ( $\sigma=28.14$ ) while average number of liveborn kids was 6.00 ( $\sigma=3.84$ ).

**Table 1. Descriptive statistics**

Variable	N	$\bar{x}$	$\sigma$	min	max
Milk yield (kg)	1580	1534.15	1230.15	47.20	8341.95
Fat yield (kg)	1578	49.51	40.19	0.69	232.92
Protein yield (kg)	1578	46.47	37.39	1.59	225.23
Lactations	1580	4.04	2.24	1.00	10.00
Age at culling (months)	1580	72.12	28.14	15.00	21.00
Liveborn kids	1580	6.00	3.84	0	21.00

N=number of observations;  $\sigma$ =standard deviation;  $\bar{x}$  -mean; min=minimum; max=maximum

## Statistical analysis

Lifetime production traits were analyzed using the following statistical model (eq. 1):

$$Y_{ijkl} = \mu + Y_i + B_j + f_k + e_{ijkl} \quad (1)$$

where  $y_{ijkl}$  is analyzed trait,  $\mu$  is intercept,  $Y_i$  is fixed effect of year of culling ( $i=1,2, \dots,7$ ) and  $B_j$  is fixed effect of breed ( $j=1,2,3$ ),  $f_k$  is farm as random effect ( $k=1,2, \dots,54$ ), and  $e_{ijkl}$  is a residual. Analyses were conducted using MIXED procedure in SAS/STAT statistical package (SAS Institute, 2011). The restricted maximum likelihood method was applied. Preliminary results showed sufficient homogenous residual variance structure.

## RESULTS AND DISCUSSION

Lifetime production of goats was affected by culling year and farm (Table 2; Figure 1A; Figure 1B). Differences between breeds were obtained in milk, fat and protein yield; however breeds did not differ in number of liveborn kids and number of completed lactations.

The results revealed the significant variance for farm effect (Table 2). The farm contributed similar proportion of phenotypic variation in milk traits: 36.11% in milk yield, 35.03% in fat yield, and 34.16% in protein yield. The contribution of variation caused by farm was smaller in liveborn kids (23.16%) and a number of completed lactations (25.10%).

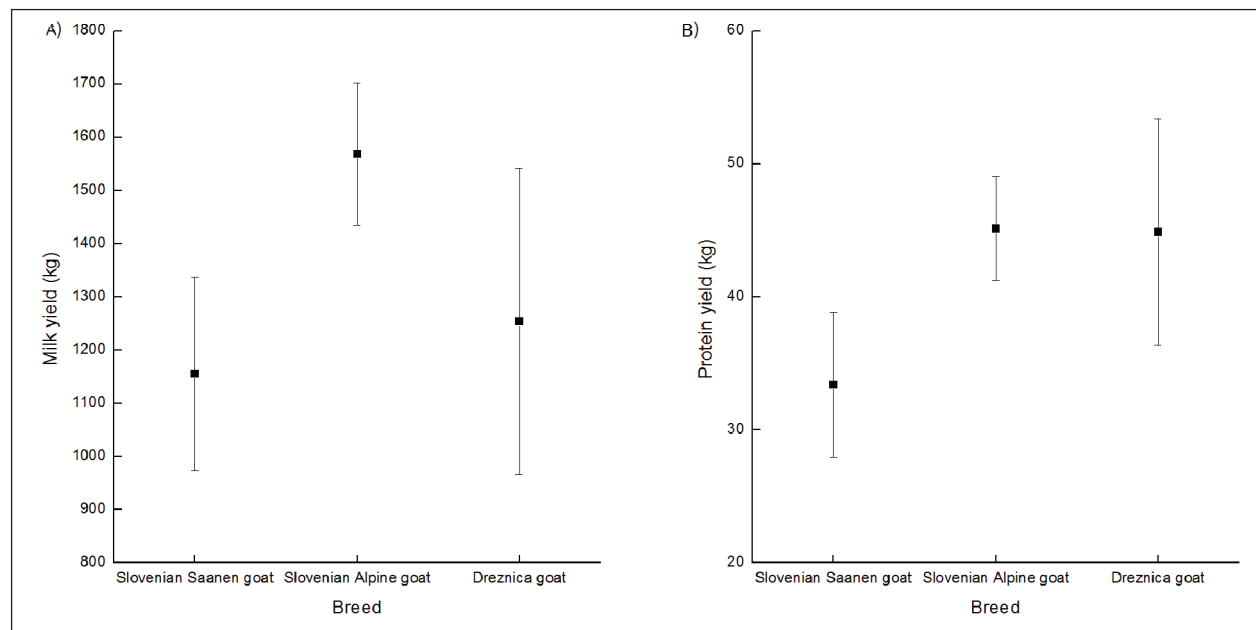
**Table 2. Statistical significance of effects on production traits and estimates of variance components with standard errors**

Trait	p-values			Estimates of variances	
	Year	Breed	Farm	$\sigma_f^2$	$\sigma_e^2$
Milk yield (kg)	<.0001	0.0454	<.0001	565146±138652	999963±36249
Fat yield (kg)	<.0001	0.0199	<.0001	585.11±149.55	1085.39±39.41
Protein yield (kg)	<.0001	0.0752	<.0001	484.09±121.50	932.83±33.84
Lactations	<.0001	0.1557	0.0001	1.26±0.34	3.76±0.14
Liveborn kids	<.0001	0.5403	0.0001	3.52±0.95	11.67±0.42

$\sigma_f^2$  –variance component of farm (in squared units);  $\sigma_e^2$ –residual variance component (in squared units)

Lifetime milk yield was higher in Slovenian Alpine goat compared to Slovenian Saanen goat by  $413.26 \pm 172.52$  kg (Figure 1A); however results showed that Dreznica goat did not differ in lifetime milk production compared to other two breeds (p-value was 0.7715 and 0.3209). Standard errors of least square means for Dreznica goat were larger because of smaller number

of animals and variability within the breed. The difference in lifetime protein yield between Slovenian Alpine goat and Slovenian Saanen goat (Figure 1B) amounted to  $11.76 \pm 5.21$  kg (p-value 0.0240). The difference between Dreznica and Slovenian Saanen goat and Slovenian Alpine goat was not significant (p-value was 0.2532 and 0.9772; respectively).

**Figure 1. Least square means for lifetime milk yield (A) and protein yield (B) for three goat breeds in Slovenia**

Dreznica goat yielded about  $25.50 \pm 5.21$  kg more fat in lifetime compared to Slovenian Saanen goat (p-value 0.0206); however compared to Slovenian Alpine goat the difference was not significant (p-value 0.2330). Comparison of Slovenian Saanen goat and Slovenian Alpine goat revealed higher lifetime fat yield of Slovenian Alpine goat for  $13.28 \pm 5.21$  kg (p-value 0.0188).

Despite the fact that prevalent breeding system in Dreznica goat is extensive with alpine pasture during the grazing season, results showed no difference in lifetime milk production compared to Slovenian Saanen and Slovenian Alpine goat which are characterized by breeding in more intensive production system, generally utilizing advanced technology. Presumably, this could be explained by excellent adaptability of autochthonous

Dreznica goat to local environmental conditions and production system. Similar lifetime milk production should be considered for the further steps of conservation of critical endangered the only Slovenian autochthonous goat breed. Furthermore, public awareness of the local and threatened breeds is increasing. Therefore, milk and dairy products of the local goat breeds may well fit into the economics niches, maintaining tradition and cultural values.

The lifetime production of local dairy goat breeds was not very widely studied. Gaddour et al. (2007) studied dairy performance such as, daily milk average, total production by lactation and milking period of local goat, Alpine, Damascus, Maurciana and crossed groups. They found lower dairy production for the local breed in com-

parison to other breeds. Zaitoun et al. (2004) observed that breed and region within geographical site and lactation number significantly affected daily milk production. Some studies were done on dairy local cattle breeds and some conclusions are maybe also applicable on local dairy goats. Avtar (2005) found much higher lifetime performance in crossbreeds than in autochthonous cattle breeds. The author continues that crossbred cattle have higher milk productivity and reproductive efficiency, hence are more profitable than local cattle. Similarly, Galukande et al. (2013) found out that lifetime milk yield was higher in cross-breeding cattle compared to local cattle. Krishanender et al. (2014) reported that the overall least squares means estimated for lifetime milk yield per day of herd life, lifetime milk yield per day of total lactation length and lifetime milk yield per day of longevity in Jersey cows were 4.77 or -0.18 kg, 6.46 + or -0.13 kg and 2.92 + or -0.12 kg respectively.

## CONCLUSION

Milk yield, as well as the milk composition, number of completed lactations and liveborn kids, indicate the differences among the years, farms and breeds. However, breeds did not differ either in number of liveborn kids or number of completed lactations. The lifetime milk yield was higher in Slovenian Alpine goat compared to Slovenian Saanen goat by  $413.26 \pm 172.52$  kg. The difference in lifetime protein yield between Slovenian Alpine goat and Slovenian Saanen goat amounted to  $11.76 \pm 5.21$  kg. Dreznica goat did not differ in lifetime milk production and protein yield compared to both intensive goat breeds. Dreznica goat yielded about  $25.50 \pm 5.21$  kg more fat in lifetime compared to Slovenian Saanen goat. However, compared to Slovenian Alpine goat the difference was not significant. Comparison of Slovenian Saanen goat and Slovenian Alpine goat revealed higher lifetime fat yield of Slovenian Alpine goat for  $13.28 \pm 5.21$  kg.

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