

Production and Reproduction Efficiency in Turcana and Ratca Sheep Breeds

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Abstract

Aim of the current comparative study was to evaluate the production and reproduction efficiency in indigenous Turcana and endangered Ratca sheep breeds. Milk yield for the two breeds was on average 68.23 ± 2.33 kg for Ratca ewes and 76.81 ± 2.99 kg in Turcana, respectively, differences between two breeds were significant ($p \leq 0.01$). Conception rates were of $97.7 \pm 0.87\%$ in Ratca and of $94.8 \pm 0.65\%$ in Turcana ewes, respectively, differences were significant between the two flocks ($p \leq 0.05$), with the Ratca ewes achieving better fertility rates, compared to their counterparts, the Turcana breed. For prolificacy, the Turcana ewes outperformed significantly ($p \leq 0.01$) the Ratca, with an average litter size of $124.2 \pm 1.86\%$ and $110.1 \pm 1.44\%$, respectively. Lambs survival and adult ewe culling rates were not affected by the breed factor ($p > 0.05$). Adult ewes body weight when put to ram was significantly ($p \leq 0.05$) influenced by the breed, with Turcana ewes having on average 53.8 ± 2.89 kg, compared to 48.0 ± 3.22 kg for the Ratca ewes. The average farm yearly incomes were estimated to be of 150.32 EUR for Ratca ewe-unit and of 144.97 EUR for the Turcana ewe-unit. Although the Turcana outperformed the Ratca ewes, the annual revenue was higher for the Ratca, due to the state conservation subsidy for rare and endangered breeds.

Keywords: endangered breeds, production efficiency, Ratca, sheep, Turcana.

1. Introduction

In Europe 40% of the livestock breeds are at risk of becoming extinct over the next 20 years [1]. Intensive production and increased commercial demands have significantly contributed to the threats facing European sheep heritage breeds, production being focused on only a few breeds in detriment of rare or minority populations, which are likely to be important genetic resources because of their adaptability, disease resistance, high fertility and unique product qualities [2].

In Romania, two indigenous sheep strains can be found, the breeds and populations belonging to the Zackel and the Tsigai groups. With some Merino derived breeds being considered as native (Palas Merino, Transylvanian Merino, Cluj Merino), together with the Karakul. The most important breed is represented by the Turcana from the Zackel strain, which accounts for over 70% of the national flock, followed by the Tsigai group, which accounts for around 18% of the sheep reared in Romania [3].

Minority breeds, such as the Ratca and the Rusty Tsigai are under genetic conservation programs, with subsidies being offered to breeders in order to preserve these genetic resources.

Generally, sheep are being reared as purebreds, the crossbreeding being practiced in only 1.4% of the national flock [4]. As a result, sheep breeds

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reared in Romania are predominantly indigenous, and crossbreeding is practiced at a small scale, mainly under semi-intensive production systems, with F₁ resulting lambs being slaughter and not used for further breeding purposes.

Turcana sheep has adult body weights of 40 to 55 kg in ewes and 60-80 kg in adult rams, with growth rates of un-weaned lambs ranging between 110 to 180 g/day when reared extensively [5], milk yields estimates of 60 to 150 kg/lactation and prolificacy rates ranging between 105 to 130% [6].

Ratca sheep are smaller size, with adult ewes having 35 to 45 kg, and adult rams between 55 to 65 kg [7, 8], with litters sizes significantly lower compared to more selected breeds, of 103-110%. The breed is endangered, and is under a national conservation plan, with the number of breeding ewes as low as 2020 reached in year 2012 [9].

To the best of our knowledge, this is the first research to follow a comparative study between the endangered Ratca sheep and the better performing and more economically important Turcana breed, in order to evaluate the current potential of the two breeds to meet market demands and help define new selection objectives and traits for the two breeds.

Aim of the current comparative study was to evaluate the production and reproduction efficiency in indigenous Turcana and endangered Ratca breeds.

2. Materials and methods

The trial was initiated starting autumn 2015 at the Research and Development Station for Sheep and Goats from Caransebes (45°25'N/22°13'E). Caransebes region has an elevation of 280 m above sea level and a total annual precipitation of 737.2 mm, with a mean annual temperature of 12.9°C. The project herd consisted of 110 purebred Turcana and 56 purebred Ratca ewes, managed under extensive rearing conditions. Ram/ewe ratio was of 1:25, for three consecutive estrous cycles (51 days), with the reproduction season starting in mid-September. Nutritional flushing was practiced for three weeks before the mating seasons, in addition, all animals had free access to potable water and mineral blocks year around. Animals were housed indoors during winter for a period of 120 days, on deep straw bedding, with a space allowance of 1.8 m² and 0.5

m² per ewe and lamb, respectively. Ewes received high-quality clovers and pastures hays *ad libitum*, with an additional 200 g of concentrates in late gestation and during suckling period. All hays and concentrates were produced on farm. Creep feeding of lambs was not practiced, they were solely reliant on the dams milk production. Lambs were weaned at 65±5 days of age.

All ewes were purebreds and included in the performance recording scheme, with the Rata flock being part of the genetic resources conservation program for the breed.

The following production and reproduction traits were evaluated for the two breeds, managed under identical conditions: milk yield, evaluated since the lambs weaning until the end of lactation, following ICAR rules; conception rates, expressed as the number of lambing ewes/ ewes put to ram; prolificacy computed as the number of born lambs/ 100 ewes which have gave birth; lambs survival from birth to weaning; culling rate evaluated at the end of lactation, just before the start of the new breeding season (September 2016); adult ewes weight when put to ram; age at first lambing evaluated only for primiparous ewes within the flock; number of weaned lambs per 100 ewes; and the wool production per ewe at shearing.

For the evaluation of farm incomes, the market prices and subsidies vales of the year 2016 were used, with the following prices being registered: ewe milk; price per kg of culled ewe; price per kg of fattened lamb; price per ton of manure; coarse wool value; state ewe subsidy; subsidy for animals included in performance recording scheme; subsidy for breed conservation (only for Ratca). The estimates were done for a flock of 100 breeding ewes/ breed unit.

Data were statistically using MiniTab14 software and differences between groups were analyzed by non-parametric Mann–Whitney–Wilcoxon test. All decisions about the acceptance or rejection of statistical hypothesis have been made at the 0.05 level of significance.

The research activities were performed in accordance with the European Union's Directive for animal experimentation (Directive 2010/63/EU) [10].

3. Results and discussion

Data for production and reproduction efficiency in Ratca and Turcana sheep breeds is shown in Table 1. Milk yield for the two breeds was on average 68.23 ± 2.33 kg for Ratca ewes and 76.81 ± 2.99 kg in Turcana, respectively. Differences between two breeds were significant ($p \leq 0.01$), with the milk production per breed being in the previously average range estimates [7, 8]. These results outline the lower milkability of the Ratca breed, with multiple implications, such as the lower incomes for rearing such animals, given that the milk production represents an important source of income in dual purpose sheep breeds, such as the ones belonging to the Zackel group. Therefore, selection for the increase milk production is recommended for Ratca, and if the production would be increased, this might lead to farmers choosing the breed for their enterprises, helping in turn to save the breed from the risk of extinction.

Conception rates were of $97.7 \pm 0.87\%$ in Ratca and $94.8 \pm 0.65\%$ in Turcana ewes, respectively. Differences were significant between the two flocks ($p \leq 0.05$), with the Ratca ewes achieving better fertility rates, compared to their counterparts, the Turcana breed.

However, although the Turcana ewes had lower conception rates, for the litter size (prolificacy), the breed outperformed significantly ($p \leq 0.01$) the Ratca, with averages of $124.2 \pm 1.86\%$ and $110.1 \pm 1.44\%$, respectively. Current results regarding the reproduction efficiency in the two breeds are in accordance with the previous estimates for the Zackel breeds [5, 6].

Lambs survival and culling rates were not affected by the breed factor ($p > 0.05$). However, the voluntary culling of breeding ewes is a management related factor, rather than being an attribute of the breed/animal.

Adult ewes body weight when put to ram was significantly ($p \leq 0.05$) influenced by the breed, with Turcana ewes having on average 53.8 ± 2.89 kg, compared to 48.0 ± 3.22 kg for the Ratca ewes. Ewes with higher body weights are desirable for the following reasons: higher body weights and body condition scores are highly and positively correlated with a higher ovulation rate, which translates into higher conception rates and prolificacy; a better selling price for the culled animals and a better and more persistent lactation, due to the body fat reserves.

Age at first lambing was not influenced by the genotype ($p > 0.05$). Both breeds are belonging to the mountain type of breeds, with yearling ewes being usually put to ram around 18 months of age. Unlike for the meat or dairy specialized breeds, the Zackel group animals reach puberty after the age of 12-14 months, rather than 6 to 8 months. With the typical reproduction season onset in mid-September.

Number of weaned lambs per ewe (numeric productivity) was of $0.89.0 \pm 0.23$ lambs for the Turcana breed, and of $0.76.0 \pm 0.36$ in the Ratca flock. Differences between the two breeds were significant ($p \leq 0.01$). This indicator is extremely important, given the implications on the overall sheep farm economics, having in mind that in most European farms (except some Mediterranean regions) the main incomes come from the lamb production. For both breeds, the number of weaned lambs per 100 breeding ewes is extremely low, and this could result in making the two breeds uncompetitive in the current European sheep market. This might result in breeders abandoning the two breeds or upgrading them with meat or dairy specialized breeds.

For the future selection schemes, the number of weaned lambs per ewe should be included as a selection trait.

Wool yield was significantly influenced by the breed ($p \leq 0.05$), with 2.7 ± 2.46 kg sheared wool in Ratca ewes and 3.2 ± 3.09 kg in Turcana sheep, respectively. Although wool production, especially in long coarse wool sheep is regarded as a marginal product, this aspect is important when rearing sheep in extensive outdoor systems, given that the fleece helps the animal to thermo-regulate and isolate. Moreover, in some years, due to the low wool prices, the shearing costs are higher than the incomes from selling the wool.

Economic farm returns estimates for a module of 100 breeding ewes from Ratca and Turcana breeds are being presented in Table 2.

For these estimates, the average selling prices during the year 2016 were used, and the governmental subsidies for the same reference year were calculated.

The average farm yearly incomes were estimated to be of 150.32 EUR for Ratca ewe-unit and of 144.97 EUR for the Turcana ewe-unit. Although the Turcana outperformed the Ratca ewes for litter size and milk yield, the annual revenue was higher for the Ratca, due to the state conservation subsidy

for rare and endangered breeds, which was of 21.97 EUR. Given the low numbers of the Ratca breed in Romania, the maintenance of this subsidy is advised, in order to avoid the census of the breed to change to endangered. Having in mind

that nowadays the Ratca breed has over 4000 breeding ewes, compared to year 2009, when the number of the breeding ewes was lower than 800 heads [4, 9].

Table 1. Means (\pm SE) for production and reproduction efficiency in Ratca and Turcana sheep breeds

Trait	Ratca	Turcana	Differences
Milk yield ¹ (kg)	68.23 \pm 2.33	76.81 \pm 2.99	**
Conception rate (%)	97.7 \pm 0.87	94.8 \pm 0.65	*
Prolificacy (%)	110.1 \pm 1.44	124.2 \pm 1.86	**
Lambs survival (%)	95.4 \pm 2.35	94.3 \pm 2.88	NS
Culling rate (%)	20.7 \pm 1.24	17.9 \pm 1.07	NS
Ewes weight ² (kg)	48.0 \pm 3.22	53.8 \pm 2.89	*
Age at first lambing (mo.)	23.4 \pm 0.44	22.7 \pm 0.59	NS
Weaned lambs per 100 ewes (%)	76.0 \pm 0.36	89.0 \pm 0.23	**
Wool production per ewe (kg)	2.7 \pm 2.46	3.2 \pm 3.09	*

¹milked milk after lambs weaning at 60 \pm 5 days of age.

²when introduced to ram in mid-September.

Table 2. Economic farm returns estimates for Ratca and Turcana (100 breeding ewes/breed unit)

Trait	Price (EUR) ¹	Ratca ewe	Ratca flock	Turcana ewe	Turcana flock
Milk income	0.57/kg	38.89	3694.65	43.78	4115.32
Culled ewes	0.76/kg	36.48	729.60	40.88	735.98
Fattened lambs	1.75/kg	36.75	2793.00	43.75	3893.75
Manure	10.98/t	4.39	439.20	4.39	439.20
Wool	0.65/kg	1.75	175.50	2.08	208
Ewe subsidy	5.84/head	5.48	548.00	5.48	548.00
Performance subsidy	4.61/head	4.61	461.00	4.61	461.00
Conservation subsidy	21.97/head	21.97	2197	-	-
Income per ewe and per flock ²		150.32	11037.95	144.97	10401.25

¹ 1 EUR = 4.55 RON; ² average market prices and subsidies value during year 2016.



Figure 1. Ratca ewe-lamb at 8 months of age



Figure 2. Ratca breeding ewes



Figure 3. Turcana breeding ewe

Furthermore, breeders abandoned the Ratca breed not only because of the lower production efficiency, the Ratca being a less hardy breed compared to Turcana, and being less suited to extensive low input production system. Which translates into higher maintenance costs with feeding, housing and treatments. For the future research, we recommend the study of the cost related factors and estimates in the two breeds, in order to have a more exact picture on possible strategies to keep the Ratca sheep numbers up, and to avoid as to the breed to become extinct.

4. Conclusions

Result shown that both breeds have overall modest production and reproduction outputs, and as a result their productivity should be improved by direct selection and throughout better feeding and housing management, in order to make the breeds competitive in the nowadays sheep market.

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