

Effects of Crossbreeding and Concentrates Feeding on Growth Rates of Goat Kids Reared under Highlands Conditions

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Abstract

Aim of the current research was to evaluate the effects that crossbreeding and concentrates feeding have on growth performance of goat kids managed under pasture conditions of the Romanian highlands. Experiments were carried out at the Research and Development Station for Sheep and Goats from Caransebes, in south-western Romania. The growth performances of two kids genotypes were studied, Carpatina purebreds and F₁ Boer x Carpatina crossbred kids, respectively. Under two experimental variants, with no concentrates allowance and with 300 g/day concentrates supplementation of the ration, respectively. Carpatina purebred kids had an average daily gain of 100.7±0.03 g/day when managed exclusively on pastures (control group), while the group fed with concentrates registered growth rates of 124.4±0.02 g/day (p≤0.05). The F₁ Boer x Carpatina crossbreeds had growth rates of 145.2±0.02 g/day when kept exclusively on pasture, while the group fed with additional concentrates registered growth rates of 211.9±0.04 g/day (p≤0.01). Genotype of the kids affected significantly (p≤0.001) the growth rates, in both experimental variants. It was concluded that both crossbreeding and, to a lesser extent concentrates feeding of kids, are influencing the growth rates of fattening kids managed under highlands conditions of Romania.

Keywords: Boer, Carpatina breed, crossbreeding, goat meat, pastures.

1. Introduction

The goats farming sector in Romania has been rapidly developing during the last decade. Currently, Romania holds a national flock of 1.362.804 goats, according to reports of the Romanian Ministry of Agriculture and Rural Development for the year 2014 [1]. With the numbers of goats increasing by 5 to 6% each year, for the last five years continuously. Overall, the national goats flock in Romania has increased with over 40%, compared to year 1990.

Furthermore, Romania holds a pasture surface of 4.9 millions hectares (roughly 30% of the countries surface) [2], which could sustain a flock of up to 16 million breeding sheep and goats. With most pastures being situated in regions listed as less favoured areas (LFA's), which leads to a significant growth potential for both the goats numbers to further increase [3]. Goats are being reared in Romania predominantly under extensive low-input production systems, with the production being orientated primarily towards milk, while the kid meat is regarded as a marginal product. Nowadays, goats are being reared in Romanian in a number of over 130.000 farming units, with an average flock size of roughly 10 breeding does/unit [4].

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The breed structure is being dominated by the indigenous unimproved Carpatina, which represents over 80% of the goats reared in Romania [5]. The Carpatina goat is regarded as low performing; however the breed has a remarkable organic resistance and adaptation. Reports concerning the breed's performance have shown modest production levels, with milk yields estimates of 220 to 350 kg/lactation, litter size of 130-160% and growth rates in kids ranging between 90 and 110 g/day [6, 7].

Starting year 2011, the Research and Development Station for Sheep and Goats from Caransebes of the Romanian Academy for Agricultural and Forestry Sciences began implementing a research programme on organic sheep and goats farming. The main objective of the project was to explore and identify technical solutions to the specific constraints of organic sheep and goats farming linked to reproduction performances, feeding strategies and management, animal health and welfare.

Aim of the current research was to evaluate the effects that crossbreeding and concentrates feeding have on growth performance of goat kids managed under pasture conditions of the Romanian highlands.

2. Materials and methods

The trial was initiated starting autumn 2013 at the Research and Development Station for Sheep and Goats from Caransebes (45°25'N/22°13'E). Caransebes region has a typical Central European humid continental climate, with the research station being located at 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. Temperatures express seasonal patterns with summer daily means of 20.1°C in July and winter daily means of -0.8°C in January.

The project herd consisted of 90 multiparous purebred Carpatina does. Two breeding herds were set-up, with half of the does (n=45), randomly selected being mated with Carpatina purebred bucks, while the second group of does were exposed to Boer bucks. Buck/doe ratio was roughly of 1:20, for two consecutive oestrous cycles (42 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 doe and kid, respectively. Does 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 organically produced on farm. Creep feeding of kids was not practiced, they were solely reliant on the dams milk production. Kids were weaned at 60 days of age.

After weaning (April, 2014), kids were divided into two groups of 20 individuals each (10 Carpatina purebreds and 10 F₁ Boer x Carpatina), balanced for body weights and sex among groups and genotypes. Group I was managed under conventional conditions, on a cultivated pasture (control group). Group II was managed under similar pasture conditions, with 300 g/day concentrates supplementation of the ration (experimental group). Both groups were kept exclusively on pasture for a period of one months, with a gradual transition from indoor housing to pasture of 10 days. Current trial was conducted for a period of 31 days, when the kids had on average 6 months of age.

Rotational fenced grazing was practiced, each of the two pastures having 6 identical in size areas (1600 m²). Kids were provided on pasture with shelter and shade, and had non-restricted access to water and mineral blocks.

Body weight was monitored using the electronic Inscale Platform Scale EOE 150 K 100 XL equipped with an animal weighing programme, in the morning at the same hour on each day, in order to obtain the highest accurate data.

The pasture was fertilized initially in two stages, first in early spring 2012 with a dose of N₁₀₀P₇₀K₇₀, and secondly, after the first harvest with a dose of N₅₀. In 2013, fertilization was made by administrating N₁₀₀ in early spring and N₅₀ after the first harvest. During both years, the pasture was used to produce bailed hay, and was not used for grazing. The following plant species were identified within the pasture: grass 59% (*Lolium perenne*, *Festuca pratensis* and *Festuca arundinacea*), legumes 2% (*Lotus corniculatus* and *Trifolium repens*) and other species 39%.

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) [8].

3. Results and discussion

Finishing body weights in F₁ Boer x Carpatina kids were of 25.4 kg and 28.8 kg, in pasture and pasture + concentrates feeding variants, respectively (Table 1). Differences among the two crossbred kids groups being significant ($p \leq 0.01$).

With a similar patterns being observed for the Carpatina purebreds, with average finishing weights of 22.9 kg and 24.5 kg, respectively. Differences among the Carpatina kids being less dramatic ($p \leq 0.05$), compared to their Boer sired counterparts.

Results suggest that the Carpatina purebreds respond to a less extent to the ration supplementation with concentrates, most likely because of the lack of selection of the breed for meat production traits, such as growth rates and carcass quality. Thus, concentrate feeding management in Carpatina finishing kids its not advisable, due to the increase of the production costs, and low response of the breed.

Overall, the Boer sired kids had finishing weights higher with 2.5 kg and 4.3 kg, compared to their Carpatina counterparts, differences being significant ($p \leq 0.001$) for both feeding strategies.

Average daily gains in F₁ Boer x Carpatina kids were significantly ($p \leq 0.01$) higher than their Carpatina purebreds counterparts. With average daily gains values of 145.2 g/day and 211.9 g/day, in crossbreeds managed under pasture conditions exclusively, and of those which had their ration supplemented with concentrates, respectively. Results are in accordance with those reported by Belay et al. (2014) [9], on using Boer bucks as terminal sires for improving kid growth rates.

The Carpatina purebred kids had average daily growth rates of 100.7 g/day and 124.4 g/day, under pasture and pasture + concentrates supplementation feeding management, respectively. Similar to previous estimates for the breed, while managed under extensive or semi-extensive production systems [7, 10].

Current results are in accordance with recent reports of Mbuku et al. (2015) [11], which found that throughout crossbreeding, the improvement of meat production rises with 18.2 kg per breeding doe per year, compared to using dairy purebreds.

Rahmann (2007) [12] in his work concerning the economic returns in dairy and meat goat sectors, has outlined that farm profitability differs to a great extent, with an average annual income of 163 EUR/lactating doe raised for milk production, while the returns for meat goats was of 36 EUR/breeding doe.

Table 1. Growth rates of F₁ Boer x Carpatina (BC) crossbreeds and Carpatina (CA) finishing kids reared on pasture

Group	Genotype	Concentrate allowance	Initial body weight (kg)	Finishing weight (kg)	Average daily gain (g)
Group 1 [A]	F ₁ Boer x Carpatina	-	20.7±0.72	25.4±1.95	145.2±0.02
Group 2 [B]	F ₁ Boer x Carpatina	YES [300 g/day]	20.8±0.94	28.8±1.94	211.9±0.02
Group 3 [C]	Carpatina	-	18.0±0.60	22.9±1.74	100.7±0.02
Group 4 [D]	Carpatina	YES [300 g/day]	18.5±0.64	24.5±1.41	124.4±0.02
<i>Differences among experimental groups (Mann-Whitney)</i>					
<i>F₁ BC vs. F₁ BC+conc. [A vs. B]</i>			0.1 NS	3.4 **	66.7 **
<i>CA vs. CA+conc. [C vs. D]</i>			0.5 NS	1.6 *	23.7 *
<i>F₁ BC vs. CA [A vs. C]</i>			2.7 *	2.5 ***	44.5 **
<i>F₁ BC+conc vs. CA+conc. [B vs. D]</i>			2.3 *	4.3 ***	87.5 ***

NS $p > 0.05$; * $p \leq 0.05$; ** $p \leq 0.01$; ***; $p \leq 0.001$



Figure 1. Boer bucks



Figure 2. Carpatina doe



Figure 3. F₁ Boer x Carpatina crossbreeds

4. Conclusions

Introducing the South African Boer meat specialized breed into crossbreeding schemes with indigenous rustic goat breeds has led to a

significant increase of the growth rates in crossbreed kids. Thus, taking great advantages of the Boer meat producing potential, the local low-input breeds high levels of adaptation and resistance to the environment, moreover taking full advantage of the heterosis effects when crossbreeding such genetically diverse breeds. Current research has outlined that both crossbreeding and, to a lesser extent concentrates feeding of kids, are influencing the growth rates of fattening kids managed under highlands conditions of Romania.

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