

Comparative Study on Growth Performance in Lambs Reared under Organic and Conventional Systems

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Abstract

Aim of the current research was to compare the growth performance in finishing lambs reared under organic production system to performances of lambs from conventional systems, under highland pastures conditions. Two genotypes were used, purebred Turcana lambs and F₁ German Blackheaded x Turcana dual-breeds, reared under two production systems, conventional versus organic. In addition, each of the production system and genotype had two experimental variants, with and without concentrates allowance, resulting 8 experimental groups. Under conventional system, lambs registered average daily gains (ADG) ranging between 258.0±0.12 and 124.0±0.20 g/day, with both genotype and experimental variant significantly ($p \leq 0.05$) influencing the growth rates. Under organic production, ADG values in lambs ranged between 227.3±0.12 and 94.3±0.08 g/day, with the factors taken into account influencing significantly ($p \leq 0.001$) the growth rates. It was concluded that production system, genotype and concentrates allowance significantly influence growth rates in finishing lambs.

Keywords: growth rates, highland conditions, organic meat, production system, Turcana.

1. Introduction

Efficiency of lamb production is controlled by reproduction rate, mothering ability and milk production of the ewes, as well as growth rate and survival rates of the lambs [1, 2].

Starting 2011, the Research and Development Station for Sheep and Goats Caransebes of the Romanian Academy for Agricultural and Forestry Sciences has been developing a research programme on organic farming, with experiments on organic sheep production being performed in Caransebes (Western Romania). The objectives of this project were to compare two reproductive systems in sheep meat production, and to explore technical solutions to the specific constraints of organic sheep farming linked to reproduction,

feeding, growth rates, health and welfare. For this, a local hardy breed (Turcana) was included in the study, managed semi-intensively and extensively, under both conventional and organic production system. Moreover, it has been reported that the highest production cost in sheep production is feeding and, above all the concentrate use, with price per kg +70% vs. conventional [3].

Comparative researches following the reproductive performance of the Turcana ewes reared under organic production systems have previously shown that under proper management and rearing conditions both the conception rate and prolificacy could reach similar values to those registered in animals reared conventionally [4].

Furthermore, in our preliminary studies we found no significant differences for survival rates and major health incidences in lambs reared under organic conditions, compared to those reared conventionally [5].

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Aim of the current research was to compare the growth performance in finishing lambs reared under organic production system to performances of lambs from conventional systems, under highland pastures conditions.

2. Materials and methods

The study was carried out at the Research and Development Station for Sheep and Goats in Caransebes, during 2013.

The following experimental design was applied: 2 production divergent systems (organic and conventional); 2 genotypes (F_1 German Blackheaded Mutton x Turcana crossbred and Turcana purebred lambs); 2 management strategies for each production system (with and without concentrates allowance), resulting in 8 experimental variants, of 10 lambs each.

Lambs at age of 5 months were introduced into the study for 30 days, in order to be finished on pasture, based on the experimental design described above. Body weight was measured at the start of the experiments and at 7 days intervals after.

Fenced, rotational grazing was practiced, with all animals having access to a water source and shade during the day.

Organic lamb meat production system being replicated based on the regulations stipulated by the Council Regulations of the European Commission (2092/91 EEC and 1804/99 EEC) and national laws and regulations.

Data were statistically evaluated 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 study was performed in accordance with the EU Directive 2010/63/EU for animal experimentation.

3. Results and discussion

In Tables 1 and 2 are shown the growth rates of lambs from the experimental groups during their finishing in both conventional and organic production systems.

In the conventional system, with the fattening of lambs on cultivated pastures, regardless of experimental variant (with concentrate supplementation or not), average daily gain in F_1 GB x TA genotype was significantly ($p \leq 0.05$) higher compared with daily growth rates of Turcana lambs from the control groups.

Administration of concentrates in the daily ration of lambs (300 g /day /head) influenced significantly ($p \leq 0.01$) average daily gains recorded by lambs included in the experiment. The average differences recorded between F_1 GB x TA lambs were of 102.67 g/ day, and between Turcana lambs of 82 g/ day.

Regarding the performance of lambs reared under organic production, data shown that lambs increased their average daily gains significantly ($p \leq 0.001$), with differences existing between the two genotypes and between the two experimental variants, respectively.

Averages differences between the two experimental variants (with and without concentrates) are the most prominent. Between the F_1 GB x TA hybrids differences for average daily gain registered were of 108.9 g/ day, and for the Turcana lambs from the control groups, breed differences in average daily gain was of 88.3 g/ day.

For both genotypes the average daily gain registered were lower compared with those reported in Awassi lambs (266 g/ day) at similar fattening weights, reared conventionally [6].

To evaluate the influence of production system on lambs growth rates in F_1 GB x TA hybrids and Turcana purebreds, differences among the 8 experimental groups were tested (Table 3).

F_1 GB x TA hybrids lambs finished under organic production system compared to the conventional system, without additional concentrates feeding, the differences registered for the average growth rates were statistically significant ($p \leq 0.01$).

In the experimental variant with concentrates supplementation of the daily ration (300 g/ day/ lamb), differences between the two systems were statistically significant ($p \leq 0.05$).

Within the groups of Turcana purebred lambs, the differences between the four experimental variants were statistically significant ($p \leq 0.01$), differences recorded were on average of 29.6 g/ day in the variant without additional concentrates, and of 23.2 g/ day at the trials with

supplementation of daily rations with concentrates.

Turcana lambs reared under organic system, with allowance to concentrates shown extremely good aptitudes for fattening, results from other studies concerning the breed reporting growth rates significantly lower [7, 8], compared to current registered values. Results are in accordance with those reported by others [9].

Results concerning performances of F1 German Blackheaded Mutton x Turcana crossbred suggest

that cross breeding native Turcana with specialized terminal sires could prove a valuable tool in improving meat performance in both organic and conventional systems.

Similar results concerning the growth performances of German Blackheaded Mutton (GB) sired lambs under the rearing conditions found in Western Romania were reported by other authors, emphasizing the breed complementarity between GB and indigenous Turcana [10, 11].

Table 1. Growth rates of F₁ German Blackheaded Mutton x Turcana crossbred (F₁GBxTA) and Turcana (TA) finishing lambs reared on conventional pasture

Group	Genotype	Concentrate allowance	Initial body weight (kg)	Finishing weight (kg)	Growth rate (kg)	Average daily gain (g)
I [A]	F ₁ GB x TA	NO	25.68±0.483	30.34±0.475	4.66±0.577	155.33±0.190
II [B]	F ₁ GB x TA	YES	25.87±0.461	33.61±0.718	7.74±0.366	258.00±0.122
III [C]	TA	NO	22.98±0.465	26.70±0.716	3.72±0.605	124.00±0.202
IV [D]	TA	YES	23.08±0.424	29.26±0.465	5.73±0.294	206.00±0.149
Differences between groups						
	A vs. B		0.19 kg NS	3.27 kg **	3.08 kg **	102.67 g **
	C vs. D		0.10 kg NS	2.56 kg *	2.01 kg *	82.00 g **
	A vs. C		2.70 kg **	3.64 kg ***	0.94 kg *	31.33 g *
	B vs. D		2.79 kg ***	4.35 kg ***	2.01 kg **	52.00 g **

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

Table 2. Growth rates of F₁ German Blackheaded Mutton x Turcana crossbred (F₁GBxTA) and Turcana (TA) finishing lambs reared on organic pasture

Group	Genotype	Concentrate allowance	Initial body weight (kg)	Finishing weight (kg)	Growth rate (kg)	Average daily gain (g)
V [E]	F ₁ GB x TA	NO	25.88±0.426	29.43±0.395	3.55±0.244	118.33±0.081
VI [F]	F ₁ GB x TA	YES	26.49±0.590	33.31±0.766	6.82±0.366	227.30±0.122
VII [G]	TA	NO	22.75±0.332	25.58±0.436	2.83±0.256	94.33±0.085
VIII [H]	TA	YES	23.48±0.336	28.96±0.551	5.48±0.400	182.70±0.133
Differences between groups						
	E vs. F		0.61 kg NS	3.38 kg **	3.27 kg ***	108.90 g ***
	G vs. H		0.73 kg NS	3.38 kg **	2.65 kg ***	88.30 g ***
	E vs. G		3.13 kg ***	3.85 kg ***	0.72 kg **	24.00 g ***
	F vs. H		3.01 kg ***	4.35 kg ***	1.34 kg **	44.60 g ***

Table 3. Differences in average daily gain (ADG) according to lambs genotype, production system and concentrate allowance

Genotype	Production system	Differences in ADG
F ₁ GB x TA	Conventional vs. organic, without concentrates	37.0 g **
F ₁ GB x TA	Conventional vs. organic, with concentrates (300 g/day)	30.7 g *
TA	Conventional vs. organic, without concentrates	29.6 g **
TA	Conventional vs. organic, with concentrates (300 g/day)	23.2 g **

4. Conclusions

It was concluded that production system, genotype and concentrates allowance significantly influence growth rates in finishing lambs in the conventional and organic rearing conditions.

Results concerning performances of F₁ German Blackheaded Mutton x Turcana crossbreds suggest that crossing native Turcana with specialized terminal sires could prove a valuable tool in improving meat performance in both organic and conventional systems. In all experimental variants, crossbred lambs had a finishing weight higher with 3.6-4.4 kg, compared with Turcana lambs, under identical rearing conditions.

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