THE ROLE OF PASTURES IN THE GROWTH PERFORMANCE OF PUREBRED TURCANA AND CROSSBRED LAMBS: A REVIEW

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Abstract

The sheep sector in Romania is an important part of the national livestock industry and relies heavily on permanent pastures as the main source of feed for sheep farms. The way in which permanent pastures are used directly influences the growth performance of lambs, as they are the main source of feed for sheep farming in Romania. This article summarizes data from the scientific literature on the average daily gain (ADG) of purebred Turcana lambs and hybrids resulting from crossbreeding with specialized meat breeds, in different types of pastures and feeding systems. Analysis of the results shows that Turcana lambs have a moderate growth rate in extensive grazing based systems, reflecting their ability to utilize feed resources with medium or low nutritional value. The application of feed supplementation in the early stages of growth leads to significant increases in average daily gain (ADG), highlighting the importance of nutritional management in the early postnatal stages. In most of the studies analyzed, Turcana × specialized meat breeds lambs show higher average daily gains than purebred lambs, both in semi-intensive and extensive systems, with these differences being more pronounced in situations of limited feeding. The scientific basis for choosing meat production strategies in sheep farming is provided by these results, which confirm how growth performance is affected by feed quality, supplementation levels, and genetic structure.

Keywords: *permanent grasslands; Turcana bred; crossbreeding; average daily gain (ADG); feeding system;*

INTRODUCTION

The sheep farming sector in Romania is an essential component of national animal husbandry, being integrated into extensive and semi-extensive farming systems where permanent pastures provide the main source of feed. According to official data published by the National Institute of Statistics, Romania's total sheep population is around 11.87 million, but these reports lack a breed-specific breakdown, hindering the accurate estimation of each breed's share of the national population (https://insse.ro/cms/ro). Several scientific studies suggest

that the Turcana breed accounts for 70-80% of the total sheep population, but these values are only estimates (Sauer M. et al., 2013; Gavojdian et al., 2016; Neață and Vintilă, 2023, https://www.anarz.eu).

Approximately 4.9 million hectares of permanent pasture are spread across the country. These areas are relatively evenly divided between pastures and hayfields: 68% are used as pastures and 32% for hay production. Around 79% of these pastures are situated in hilly and mountainous regions. These areas have significant livestock potential. However, researchers often do not exploit them properly (Samuil, C. and Vîntu, V., 2012; Mocanu, V. et al. 2021; Cojocariu Luminita, 2022; Rotar, I. and Vidican Roxana, 2003;). At the same time, Romania's sheep sector has experienced an overall upward trend between 2014 and 2024, positively impacting the economy. According to data published by the National Institute of Statistics (INS), the total sheep population was approximately 10.94 million in 2014, increasing to 11.87 million in 2024 (Table 1). This indicates a gradual increase in the popularity of the species (https://insse.ro).

Table 1

Evolution of sheep and goat livestock in Romania between 2014 and 2024 (thousand heads) and year to year differences

Year	Sheep and goats – total	Differences (±) compared to the previous year	Sheep, ewes, and goats	Differences (±) compared to the previous year
2014	10935.4	-	8521.3	-
2015	11249.7	+314.3	8704	+182.7
2016	11358.6	+108.9	8730.5	+26.5
2017	11485.1	+126.5	8833.9	+103.4
2018	11715.7	+230.6	8921.4	+87.5
2019	11953.6	+237.9	9166	+244.6
2020	11893.3	-60.3	9052.2	-113.8
2021	11580	-313.3	8941.3	-110.9
2022	11730.5	+150.5	10093.5	+1152.2
2023	11721.2	-9.3	10063.7	-29.8
2024	11869.5	+148.3	10232.7	+169

Note: the data are expressed in thousands (INSSE, 2024). In this paper, the values are also presented in millions for ease of interpretation (e.g., 11,869.5 thousand = 11.87 million) Source: https://insse.ro

The scientific consensus is that the Turcana breed is the most widespread in the sheep sector. It is excellently adapted to the conditions of the Carpathian Mountains and hilly areas, where grazing remains the main source of fodder. Pastures used by sheep flocks exhibit distinct differences in terms of floristic composition, green mass production, vegetation density, the developmental stage of dominant

species and dry matter content (Tafta V., 2003; Pădeanu I., 2003; Voia S., 2005; Pașca I. and Roman M., 2007; Păcurar F. and Rotar I., 2014).

In sheep farming systems that use permanent pastures, the growth performance of lambs is an important indicator of biological efficiency. This is expressed as average daily gain (ADG) and is influenced by the quality of the feed, the level of supplementation and the genetic potential of the animals. The growing interest in meat production has led to the diversification of farming practices through the use of the Turcana breed, both purebred and crossbred with meat specialised breeds, while maintaining adaptability to farming on permanent pastures. In the context of both the national and European situations, this paper aims to evaluate the influence of pasture type and feeding systems on the growth performance of Turcana breed lambs and Turcana × specialized meat breeds, as measured by average daily gain (ADG).

The study aims to establish effective meat production guidelines in extensive and semi-intensive sheep farming systems. The study aims to perform a comparative analysis of ADG according to pasture type and feed supplementation level, evaluate the influence of genetic potential on growth rate and highlight the relationships between feed resource quality and lamb growth performance (Tafta V. et al., 1997; Pascal C., 2007a; Pascal C., 2007b; Pădeanu I., 2010).

MATERIAL AND METHOD

This analysis was conducted through systematic bibliographic research, focusing on average daily gain (ADG) in Turcana lambs, as well as in lambs resulting from crosses between Turcana and other meat breeds (Turcana × Ile de France, Turcana × Lacaune, Turcana × Norwegian White, Turcana × German Blackheaded Mutton and Turcana × Blackheaded Mutton). The studies were identified in academic databases such as Google Scholar, PubMed, Web of Science and Scopus, using keywords: "Turcana lambs, Turcana crossbreeding, pasture fed lambs, Turcana feeding systems, average daily gain". Indexed Romanian journals and relevant academic literature were also consulted. Eligible studies had original data on body weight and ADG, analysed the Turcana breed or Turcana × specialized meat breeds, described the rearing conditions (type of pasture, feed supplementation and duration of the experiment) and provided clear information on the number of animals and their age range. Studies without quantitative data, papers without scientific evaluation, and articles unrelated to the objectives of the paper (e.g. exclusively focusing on lactation, pathology or molecular genetics) were excluded. The following data were extracted for each study:

number of animals; age range analysed; type of pasture; feeding system; duration; and ADG values. The data were summarised in two tables: the first for the pure Turcana breed and the second for the Turcana × specialized meat breeds. This approach enabled a direct comparison of the influence of genotype, pasture and feeding on growth performance.

RESULTS AND DISCUSSIONS

The results obtained are summarised in Tables 2 and 3, which present the growth performance of Turcana lambs and Turcana × specialized meat breeds, expressed as average daily gain (ADG), depending on the type of pasture and feeding system.

The data presented in Table 2 provides a overview of the results obtained from various studies on the growth performance of Turcana lambs under different feeding conditions and farming systems. In a study by Pădeanu et al. (2004), 12 purebred Turcana lambs were monitored from birth until they were 155 days old. Their body weight was recorded at 0, 14, 30, 60, 80, 100, 120 and 155 days. Initially, the lambs were fed maternal milk and hay, and from two weeks of age they were switched to a concentrate feed containing 16% crude protein. They were subsequently switched to a semi-intensive feed mixture containing 12.18% crude protein and 0.76 nutrient units/kg. Analysis of the growth rate showed average daily gains of 232 g between days 0 and 30, 192 g between days 0 and 60, 182 g between days 0 and 80, 170 g between days 0 and 100, 166 g between days 0 and 120, 164 g between days 0 and 140 and 168 g for the entire period from days 0 to 155. This describes the growth trajectory specific to this batch of lambs under semi-intensive conditions. Pascal et al. (2009) conducted another experiment on young Turcana sheep (black and white varieties), both male and female, with 25 animals in each group. The sheep were fattened for 175 days in a semi-intensive system with uniform housing conditions and feeding adapted to technological stages (10 days of adaptation, 135 days of fattening, and 30 days of finishing). Growth performance was monitored by weighing the animals at the start and end of each phase. The results showed average daily gains of 125 ± 7.9 g for black males, 112 ± 7.1 g for black females, 116 ± 6.1 g for white males, and 108 ± 7.3 g for white females. At slaughter, yields ranged from approximately 44.1% for black Turcana males to 39-40% for white Turcana female. Pădeanu et al. (2009) evaluated 35 white Turcana lambs over an age range of 0-8 months, taking body weight measurements at birth and at 60, 90, 180 and 240 days. The lambs were raised in a maternal system with free access to milk. From three weeks of age, they received an additional 250 g/day of concentrates identical in structure to those used in the hybrid batch.b

Table 2

The growth performance (ADG - average daily gain) of purebred Turcana lambs in different feeding systems

Reference	Breds/Lot-number/ Ages	Weighings	Pasture/ Feeding system	ADG - average daily gain (g/day)
Pădeanu et al., 2004	Turcana purebreds (12 heads); during the period between lambing and 5 months of age	Frequent weighings from birth to 155 days	Milk and hay + concentrated semi-intensive feeds type, 12.18% crude protein (CP) and 0.76 nutritional units (NU) kg	168 g/day
Pascal et al., 2009	Turcana black variety and Turcana white variety (males group, females groups)	-	Semi-intensive system; same conditions for all lots	Turcana black -males (125.5 g/day); Turcana white -males (116 g/day); Turcana black - females (112 g/day); Turcana white - females (108 g/day)
Pădeanu et al., 2009	White Turcana; 35 young ewes; 0-8 months	Weaning at :birth 2 -3-6-8 months	Suckling: ad libitum milk; after 3 weeks until weaning: 250 g/day concentrates (50% barley, 50% corn); After weaning: only improved natural pasture	White Turcana: 123 g/day
Nagy et al., 2010	Turcana; 5 lambs ages beginning: 154 days end: 233 days; duration of the study: 79 days	Start of fattening End of fattening Additional measurements at slaughter	65 days- alfalfa hay ad libitum; the last 14 days- finishing diet consisting of alfalfa hay + compound feed for young sheep	Turcana 171.4 g/day (total ADG for the 79 days)
Gavojdian et al., 2011	Turcana purebreds (33 heads)	0, 28, 240 days	Hay + pasture; after 28 days, only natural pastures (after weaning), lambs were kept on pastures 24/7, and were fed only with green fresh feed from natural-unimproved pasture of low quality; no concentrated feed	194 g/day (0-28 days); 138 g/day (0-240 days) average body weight was 37.00 kg.
Zaharia et al., 2012	Turcana breed; 20 weaned lambs of the (aged 3 to 6 months)	Monthly	Traditional system of breeding / Semi-intensive system of breeding + supplements	59,3 g/day vs 152,5 g/day; final live weight 20.94 g/day vs. 29.46 g/day kg
Gavojdian et al., 2016	Turcana purebreds; 20 heads after weaning	-	Conventional pasture; Organic pasture	Turcana 206,0 g/day (conventional pasture); Turcana 182,7 g/day (organic pasture)

Source: (data from the specialized literature)

After weaning, maintenance was carried out exclusively on improved natural pasture. Average daily gains were 205 g/day in the first two months, 150 g/day between two and three months, 100 g/day between three and six months, and 70 g/day between six and eight months. This corresponds to an average daily gains (ADG) of 95 g/day for the two-to-eight-month interval, and 123 g/day for the zero to eight month interval. Additional data are provided by Nagy et al. (2010), who analysed a control group of five Turcana breed rams over a period of 79 days and took body weight measurements at the beginning and end of the interval.

The feeding regimen included 65 days of alfalfa hay, followed by 14 days of alfalfa hay supplemented with feed for young sheep. The average daily gain was 171.4 g/day, and data obtained at slaughter included live weight, slaughter yield, and anatomical measurements of the carcass.

Gavojdian et al. (2011) monitored a group of 33 purebred Turcana lambs from birth until they were 240 days old, taking body weight measurements at 0, 28, and 240 days. The animals were not given any concentrates, instead being fed hay and green fodder from the pasture until weaning. They were then maintained exclusively on unimproved natural pasture. Average daily weight gains were 194.12 g/day for the first 28 days and 138.45 g/day for the full 0-240 day period. Zaharia et al. (2012) also highlight differences determined by feeding systems by comparing two groups of weaned Turcana lambs with an average age of three months and an initial weight of 15 kg. One group was fed a traditional diet of natural hay and wheat bran (150 g per day), while the second group was raised on improved pasture supplemented with wheat (150 g per day). The respective average daily weight gains were 59.3 g and 152.5 g. In a later study, Gavojdian et al. (2016) examined 40 purebred Turcana lambs that were separated from their mothers at around 65 days of age. The lambs were acclimatised to grassland for approximately 10 days, after which they were reared exclusively on grassland for four months without any concentrates being provided. Monitoring by weighing at the beginning and end of the period showed average daily weight gains of 206 g/day and 182.7 g/day in the conventional and organic systems, respectively. The data presented in Table 3 summarises the results obtained in several studies on the growth performance of hybrid lambs resulting from the crossbreeding of the Turcana breed with specialized meat breeds, evaluated under different feeding conditions and farming systems.In the study conducted by Pădeanu et al. (2004), a group of 12 F1 Turcana × Ile de France lambs was monitored over a period of 155 days, with successive weighings at 0, 14, 30, 60, 80, 100, 120, and 155 days. Until weaning at 80 days of age, the animals were fed maternal milk, hay administered from approximately two weeks of age, and a concentrate with 16% crude protein, and subsequently received a semi-intensive feed mixture with 12.18% crude protein. The growth dynamics calculated at intervals indicated average daily gains of 246 g/day between 0-30 days, 202 g/day between 0-60 days, 196 g/day between 0-80 days, 189 g/day between 0-100 days, 184 g/day between 0-120 days, 184 g/day between 0-140 days, and 192 g/day for the entire 0-155 day interval, values that reflect the body evolution specific to this genotype under the semi-intensive conditions of the study. Another experiment, reported by Pădeanu et al. (2009), followed a group of 14 Turcana × Lacaune hybrid lambs from birth to 8 months of age, with body weight measurements at 0, 60, 90, 180, and 240 days.

Table 3

The growth performance (ADG - average daily gain) of Turcana × crossbred lambs for meat in different feeding systems

Reference	Breds/Lot- number/ Ages	Weighings	Pasture/ Feeding system	ADG - average daily gain (g/day)
Pădeanu et al., 2004	F1 Turcana × Ile de France; 12 heads- during the period between lambing and 5 months of age	Frequent monitoring from birth to 155 days	Milk and hay + concentrated semi-intensive feeds type, 12.18% crude protein (CP) and 0.76 nutritional units (NU) kg	192 g/day
Pădeanu et al., 2009	White Turcana × Lacaune; 14 young ewes; 0-8 months	Weaning at :birth 2 -3-6-8 months	Suckling: ad libitum milk; after 3 weeks until weaning: 250 g/day concentrates (50% barley, 50% corn); After weaning: only improved natural pasture	White Turcana × Lacaune: 137 g/day
Nagy et al., 2010	Norwegian White × Turcana; 5 lambs; ages beginning: 154 days end: 233 days; duration of the study: 79 days	Start of fattening; End of fattening; Additional measurements at slaughter	65 days- alfalfa hay ad libitum; the last 14 days- finishing diet consisting of alfalfa hay + compound feed for young sheep	Norwegian White × Turcana 212 g/day (total ADG for the 79 days)
Gavojdian et al., 2011	German Blackheaded Mutton × Turcana; (48 heads)	0, 28, 240 days	Hay + pasture; after 28 days, only natural pastures (after weaning), lambs were kept on pastures 24/7, and were fed only with green fresh feed from natural-unimproved pasture of low quality; no concentrated feed	229 g/day (0–28 days); 168 g/day (0–240 days) Weight at 240 days in F1 German Blackheaded Mutton x Turcana lambs was on average 45.13 kg
Gavojdian et al., 2016	F1 × 20	-	Conventional pasture; Organic pasture	F1 German Blackheaded x Turcana 258,0 g/day (conventional pasture); F1 German Blackheaded x Turcana 227,3 g/day organic pasture)

Source: (data from the specialized literature)

The animals were initially kept in a maternal system, with ad libitum milk consumption, and from the age of three weeks they received an additional 250 g/day of barley and corn-based concentrates. After weaning, maintenance was carried out exclusively on improved natural pasture. Average daily gains were 209 g/day in the first two months, 170 g/day between 2-3 months, 120 g/day between 3-6 months, and 80 g/day between 6-8 months, corresponding to an ADG of 113 g/day for the 2-8 month interval and a total average daily gain of 137 g/day for the entire 0-8 month interval. Additional data are provided by Nagy et al. (2010), who evaluated a batch of 5 F1 Norwegian White × Turcana ram lambs in a 79-day fattening cycle. Body weight was determined at the beginning of the period, at an average age of 154 days, and at the end, at 233 days. The animals were fed exclusively alfalfa hay for the first 65 days and, for the last 14 days, received a finishing ration based on alfalfa hay supplemented with compound feed intended for young sheep. The average daily gain calculated for the entire interval was 212

g/day, and the data obtained at slaughter included final weight, slaughter yield, and carcass conformation. Under extensive restrictive conditions, Gavojdian et al. (2011) monitored a batch of 48 F1 German Blackheaded Mutton × Turcana lambs over a period of 0-240 days, with body weight measurements at 0, 28, and 240 days. The animals were raised without concentrate supplementation, having access to hay and green fodder until weaning, and subsequently to continuous grazing on low-quality natural pasture. Average daily gains were 229.46 g/day over the 0-28 day period and 168.35 g/day for the entire 0-240 day period. In a subsequent study, Gavojdian et al. (2016) analyzed a batch of 40 F1 German Blackheaded × Turcana lambs, weaned at 65 ± 5 days and adapted for approximately ten days to grazing. The animals were raised for four months in an extensive system, exclusively on pasture, without the administration of concentrates, but with access to water and salt. Weighings performed at the beginning and end of the period showed average daily gains of 258 g/day in the conventional system and 227.3 g/day in the organic system. In Romania, the Turcana breed forms the basis of the national sheep population and is primarily used in extensive and semi-intensive systems. In terms of productive performance, lambs of this breed have lower growth potential than breeds specialised for meat production due to their genetic characteristics and the level of intensification of the rearing system. Growth rate is influenced by maintenance systems and nutrition levels, particularly the structure and balance of feed rations. Under grazing conditions without supplementary concentrated feed, daily weight gain is limited. These characteristics highlight the adaptability of the Turcana breed to extensive conditions at the expense of superior growth and fattening performance (Pădeanu I., 2003; Voia S., 2005; Coroian C. et al., 2009; Pascal C. et al., 2009).

CONCLUSION

The average daily gain (ADG) of Turcana lambs depends directly on their nutritional intake. Higher values are seen in systems with feed supplements, while lower values are seen in extensive conditions without concentrates. In systems based exclusively on permanent pastures, the Turcana breed exhibits a moderate and stable growth rate, reflecting its capacity to utilise feed resources of medium or low nutritional value. Applying feed supplementation in the early stages of growth leads to significant increases in ADG, highlighting the importance of nutritional control during the early postnatal period. Hybrid lambs from the Turcana × specialized specialized meat breeds record higher average daily gains than purebred lambs under comparable feeding conditions in both semi-intensive and extensive systems. Performance differences between genotypes are accentuated under limited feeding conditions, indicating the higher biological efficiency of hybrids in utilising

available feed resources. Using the purebred Turcana breed is justified in extensive systems based on permanent pastures, whereas crossbreeding with specialized meat breeds is an effective technological option for increasing ADG in systems with meat production objectives. Lamb growth performance is the result of the interaction between pasture quality, supplementation level and genetic structure. These parameters must be correlated with the farming system to optimise meat production.

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