Effects of Using Dorper, Hampshire Down, Bluefaced Leicester and German Blackheaded Rams as Terminal Sires in Extensive Low-Input Production Systems

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Abstract

The current study was conducted to evaluate Dorper, Hampshire Down, Bluefaced Leicester and German Blackheaded breeds as terminal sires in an extensive low-input production system under European temperate conditions, when crossed with native Turcana breed as a maternal genotype. The project breeding herd consisted of 300 multiparous purebred Turcana ewes, managed under extensive low-input production system. Six breeding herds were set-up, with randomly selected ewes (50/group) being exposed to Dorper, Hampshire Down, Bluefaced Leicester, German Blackheaded and Turcana (control group) rams. Lambs birth weight was higher ($p \leq 0.01$) in F_1 Hampshire Down x Turcana and F_1 German Blackheaded x Turcana crossbreds compared to control group. Lamb survival from birth to weaning was the lowest (88.4±3.30%) for the Dorper sired lambs, and the highest (94.0±1.84%) in the Bluefaced Leicester sired lambs ($p \leq 0.01$). Hampshire Down and German Blackheaded sired lambs had similar survival rates as the purebreds Turcana lambs ($p > 0.05$). Body weight of lambs at the age of 8 months was significantly higher ($p \leq 0.001$) in Dorper (41.3±0.51), Bluefaced Leicester (41.2±0.34) and German Blackheaded (42.4±0.58) sired genotypes, while the Hampshire Down half-breeds (39.3±0.65) had intermediate body weights ($p \leq 0.01$) compared to the controls (34.6±0.49).

Keywords: Bluefaced Leicester, Dorper, Hampshire Down, German Blackheaded, sheep, Turcana.

1. Introduction

In Europe, sheep production systems vary greatly among countries and regions. In most Mediterranean countries, the production of dairy sheep is predominant [1], while in North, Central and Eastern Europe, meat has become the main product [2]. The substantial diversity among sheep breeds, production environments and management systems requires systematic and comprehensive breed evaluations, in order to allow producers to identify genotypes that are best suited for their production systems and meet current market demands [3]. Furthermore, exotic breeds are often being introduced into various rearing systems without adequate knowledge on their levels of acclimatization to those specific conditions [4], which can lead to poor efficiency in sheep production and have detrimental impacts on the environment and animal welfare [5, 6].

Currently, in the European Union are being reared 83.971.700 sheep [7], with a total annual production of 925.000 tons of sheep meat, having a self-sufficiency rate of 88%. The EU exports around 8% of its total production, while imports

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are around 212.000 tons/year, mainly coming from New Zealand and Australia (94%), which represents 23% the EU's own consumption [8]. Moreover, the EU sheep numbers have decreased continuously during last 10 years, reaching 85.2% in 2014, compared to year 2004.

In Eastern and Southern Europe, majority (over 85%) of the sheep and goats flocks are being reared in mountainous and disadvantageous areas, called Less Favored Areas (LFAs) as defined in Dir.75/268/EEC, having an important economic, social and ecological role, and also contributing to the conservation of the environment [9]. With most of the local breeds reared belonging to the Zackel and Tsigai group breeds [10, 11].

Romania ranks third in the EU in terms of sheep numbers (9.51 millions), having self-sufficiency for sheep meat of 150% and therefore exports are important at national level [8]. Over the last years, exports of live animals increased significantly, with exports of live lambs going mainly to the Middle East and North Africa. Moreover, the country has a pasture surface of 4.9 million ha, which could sustain up to 16 million sheep [12]. More than 95% of sheep are reared under extensive low-input production systems, and the breed structure is dominated by indigenous, unimproved breeds. Romanian indigenous Turcana, accounting for over 6 million breeding ewes [13], is one of the most representative breeds belonging to the Eastern European Zackel group, reared in 14 countries from Central, Eastern and South-Eastern Europe. With adult body weights of 30-50 kg in ewes and 60-80 kg in rams, growth rates in un-weaned lambs of 110-180 g/day [14], milk yields estimates of 60-150 kg/lactation and prolificacy rates ranging between 105-130% [15]. Overall, the meat production potential of the breed is modest, making the breed uncompetitive for the current marked demands.

The current study was conducted to evaluate Dorper, Hampshire Down, Bluefaced Leicester and German Blackheaded breeds as terminal sires in an extensive low-input production system under European temperate conditions.

2. Materials and methods

2.1. Location and animals

Experiments were carried out at the Research and Development Station for Sheep and Goats Caransebes, (45°25'N/22°13'E; 280 m altitude; 737.2 mm average annual rain fall; with a mean annual temperature of 12.9°C, 20.1°/0.8°C during summer/winter).

The project breeding herd consisted of 300 multiparous purebred Turcana ewes, managed under extensive low-input production system. Six breeding herds were set-up, with randomly selected ewes (50/group) being exposed to Dorper, Hampshire Down, Bluefaced Leicester, German Blackheaded and Turcana purebred rams. Ram/ewe ratio was 1:25, for three consecutive estrous cycles, with the reproduction season starting in mid-September.

During grazing season (March-December), ewes were exclusively reared on fenced natural pastures, grazing being done rotationally, with an average stocking rate of 5-7 heads/hectare. Animals were housed indoors during winter for a period of 90 days, on deep straw bedding, with a space allowance of 1.8 m^2 and 0.5 m^2 per ewe and lamb, respectively. Ewes received medium-quality pastures hays *ad libitum*, with an additional 200 g of concentrates in late gestation and during suckling period. Creep feeding of lambs was not practiced; they were solely reliant on their dam’s milk production. Lambs were weaned at 85±5 days of age. After weaning, lambs were kept exclusively on pasture for a period of nine months, with a gradual transition from indoor housing to pasture of 14 days. Lambs were provided on pasture with shelter and shade, and had non-restricted access to water and mineral blocks.

At the age of 8 months, all male lambs were sent to the slaughterhouse, while female lambs joined the breeding herd, and were backcrossed with the sire breed.

The research activities were performed in accordance with the European Union’s Directive for animal experimentation (Directive 2010/63/EU) [16].

2.2. Data collection and statistical analysis

Individual lamb records were made by identifying the birth type, ear-tag number, birth weight and date, dam and sire genotype, weight at 28, 60, 90 and 240 days. Survival rates of lambs from birth to weaning were recorded.

Conception rate in maiden-ewes was calculated as the ratio between the numbers of ewes lambing relative to the total number of the females exposed to ram/genotype. Litter size (prolificacy) was computed as the ratio between the number of

lambs obtained relative to the number of ewes lambing/genotype.
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 (07:30 a.m.), in order to obtain the highest accurate data.
In order to assess the effect of the sire genotype (breed) on the above-mentioned production and reproduction performances of lambs, the STATISTICA software was used [17].
The Main Effect ANOVA analysis of variance was applied. The mathematical model used for the statistical analysis is presented below:

$$yijk = \mu + gj + eijk$$

where *yijk* is the studied trait (growth, survival and reproduction data); μ is the overall mean; *gj* represents the random effect of the sire-genotype with five levels: Dorper, Hampshire Down, Bluefaced Leicester, German Blackheaded and Turcana; and *eijk* is the residual effect. When significant effects of the sire-breeds were observed, the comparison among genotypes was tested by performing contrast analysis, using Tukey test.
All decisions about the acceptance or rejection of statistical hypothesis have been made at the 0.05 level of significance.

3. Results and discussion

Results for lamb weights at birth, 28 days, 60 days and 90 days of age in Dorper, Hampshire Down, Bluefaced Leicester and German Blackheaded sired progeny the control group (Turcana purebreds) are presented in Table 1.
Lambs birth weight was significantly higher ($p \leq 0.01$) for the F_1 Hampshire Down x Turcana and F_1 German Blackheaded x Turcana crossbreds, compared to their counterparts.
Birth weight is an important indicator when meat sheep are concerned, given that the lamb survival rates are superior in lambs having higher birth weights.
However, higher birth weights and conformations could result in dystocia, especially in medium-sized dam-breeds, such as Turcana (45-55 kg in adult ewes), when crossed to meat specialized breeds, in which the rams have adult body weights of 80 to 120 kg.
Moreover, some of the meat sire breeds, such as the South African Dorper, are being known that give offspring with lower birth weights.
No case of dystocia was observed during the current trial for all five genotypes studied.
Body weight of lambs at 28 days of age was significantly higher for the Dorper sired lambs ($p \leq 0.05$) and for the Hampshire Down x Turcana and German Blackheaded x Turcana crosses ($p \leq 0.01$), when compared to the Turcana purebreds. No differences between the control lambs and the Bluefaced Leicester sired lambs were observed ($p > 0.05$). The Bluefaced Leicester although is not a meat specialized breed, was used for simple crossing with the native Turcana, in order to improve the overall meat production in progeny ewe lambs, throughout a higher prolificacy (higher lamb crops).
Until the age of 22-28 days, most of the growth rates are being sustained by the ewe-dams milking ability, given that during the first three weeks of life, lambs rely on their milk inputs in order to grow, and the feed consumption is reduced.
In Romania, some farmers choose to wean the lambs at the age of 60 days (April-May), in order to milk the ewes for the remaining period of lactation (August-September), with lambs being slaughtered for the Easter celebration. Thus, body weight at the age of 60 days it is an important trait to take into consideration when crossing for meat production.
During the current research trial, the Dorper, Hampshire Down and German Blackheaded sired lambs had significantly higher live body weights ($p \leq 0.001$) compared to the native Turcana purebreds. The prolific crossbreds had significantly higher body weights as well, compared to the controls ($p \leq 0.01$).
At the age of 90 days, all meat crossbred lambs had higher body weights, compared to that of the Turcana purebreds ($p \leq 0.01$), while the prolific Bluefaced Leicester lambs had intermediary body weights, between the meat and unimproved lambs ($p \leq 0.05$).
Data for lamb survival, body weight at 8 months of age, conception rates and litter size in Dorper, Hampshire Down, Bluefaced Leicester and German Blackheaded sired progeny are presented in Table 2.
Lamb survival from birth to weaning was the lowest for the Dorper sired lambs, and the highest in the Bluefaced Leicester sired lambs ($p \leq 0.01$).

Hampshire Down and German Blackheaded sired lambs had similar survival rates as the purebreds Turcana lambs (p>0.05).

As a result, special attention should be paid by the commercial sheep breeders when crossing native breeds with Dorper rams, given the divergent breeding conditions found in South Africa, compared to those found in continental Europe. Possible, the lambing should be programmed to start in mid spring, rather than the end of winter, when temperatures are higher, given that the Dorper is a hair breed, and the animals are predisposed to pneumonia during the cold season.

Body weight of the ewe-lambs at the age of 8 months was significantly higher in all crossbred genotypes, compared to Turcana native animals (p≤0.001). Higher body weights at the age of 8 months means that the farmers could consider putting the ewe-lambs to ram at the age of 8 to 10 months, with evident economic implications, rather than at the age of 18 months how is being currently practiced.

Conception rates in primiparous ewes were significantly affected by the genotype (p≤0.001), except for the Hampshire Down x Turcana crossbred ewe-lambs.

Litter size for the prolific Bluefaced Leicester x Turcana ewe lambs was significantly higher (p≤0.001) when compared to the Turcana purebreds and the meat-specialized genotypes.

Table 1. Means (±SE) for lamb weights at birth, 28 days, 60 days and 90 days of age in Dorper, Hampshire Down, Bluefaced Leicester and German Blackheaded sired progeny

Genotype	Birth weight (kg)	28 days weight	60 days weight	90 days weight
Dorper x Turcana [A]	3.9±0.07	9.8 ± 0.12	18.6±0.26	24.3±0.23
Hampshire Down x Turcana [B]	4.1±0.09	12.2±0.18	19.3±0.33	23.8±0.11
German Blackheaded x Turcana [C]	4.8±0.11	11.2±0.16	19.8±0.20	24.1±0.16
Bluefaced Leicester x Turcana [D]	3.5±0.05	8.3±0.05	16.1±0.08	20.7±0.09
Turcana [E] (control group)	3.5±0.07	7.9 ± 0.08	13.1±0.08	19.1±0.17
Differences				
A *vs.* E	*NS*	*	***	**
B *vs.* E	**	**	***	**
C *vs.* E	**	**	***	**
D *vs.* E	*NS*	*NS*	**	*

^{NS} *P>0.05;* * *P≤0.05;* ** *P≤0.01;* *** *P≤0.001*

Table 2. Means (±SE) for lamb survival, body weight at 8 months of age, conception rates and litter size in Dorper, Hampshire Down, Bluefaced Leicester and German Blackheaded sired progeny

Genotype	Lamb survival (%)	Body weight at 8 mo. (kg)	Conception rate (%)	Litter size (%)
Dorper x Turcana [A]	88.4±3.30	41.3±0.51	79.3 ± 7.41	126.0 ± 8.93
Hampshire Down x Turcana [B]	90.8±1.60	39.3±0.65	24.3± 3.44	111.3±4.33
German Blackheaded x Turcana [C]	91.6±0.04	42.4±0.58	84.0±7.48	109.5±6.56
Bluefaced Leicester x Turcana [D]	94.0±1.84	41.2±0.34	94.7±2.11	159.2±4.30
Turcana [E]	91.1±3.58	34.6±0.49	19.3 ± 7.17	116.6 ± 1.74
Differences				
A *vs.* E	**	***	***	*
B *vs.* E	*NS*	**	*NS*	*NS*
C *vs.* E	*NS*	***	***	*NS*
D *vs.* E	**	***	***	***

4. Conclusions

Throughout the use of meat specialized Dorper, Hampshire Down and German Blackheaded rams, in simple crossbreeding schemes at commercial levels, the meat production could be much improved when extensive production systems are concerned.

The improvement of lamb crops per ewe are to be taken into consideration, and further crossbreeding of the native Turcana with the prolific Bluefaced Leicester should be practiced, given the high prolificacy that the F_1 ewes express under low input production systems.

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