

Effects of Production System on Reproduction Efficiency in Dairy Sheep

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Abstract

Aim of the current research was to evaluate the effects of the rearing system, organic versus conventional, on the reproduction efficiency when rearing Turcana sheep under extensive low-input conditions. The study flocks consisted out of 120 adult multiparous ewes, managed under conventional and organic production systems, with ewes being reared for dairy production under highland areas. Conception rates were on average of 96.6±0.84% and 97.5±0.66% in organic and conventional system, respectively ($p>0.05$), while the prolificacy was of 124.6±1.47% for the organically reared ewes, and of 118.3±1.23% for those reared under conventional system ($p\leq 0.05$). Milking ability of dam-ewes from lambing till 28 days, was of 4.86±1.44 kg on the organic flock and of 4.45±2.10 kg for the conventional animals ($p>0.05$). Survival rates of the lambs from birth till the age of weaning (70±10 days of age) were of 94.3±1.68 % and 95.7±0.33 % for the organic produced lambs and the conventional born ones, respectively ($p\leq 0.05$). Current results outline that the production system when dairy sheep are concerned, has an effect on the reproduction efficiency and on the overall farm returns, give that lamb production represents an important source of income in commercial farms.

Keywords: organic systems, production efficiency, reproduction output, sheep, Turcana.

1. Introduction

The sheep organic farming sector in the EU has been rapidly developing during the past two decades. In 2015, in Romania 2.09% of the total utilized agricultural area (UAA) was cultivated under organic production systems, compared to the average of 5.91 at EU level [1].

In Eastern and Southern Europe, the majority (over 85%) of sheep flocks are being reared in mountainous and disadvantageous areas, called Less Favored Areas (LFA's) as defined in Dir.75/268/EEC, having an important economic,

social and ecological role, and also contributing to the conservation of the environment [2].

Sheep and goats are being reared in Romania nearly exclusively under extensive low-input production systems, with the breed structure being dominated by indigenous rustic breeds, such as the Turcana (Zackel type), which account for over 70% of the sheep reared in the country [3, 4].

The Turcana breed is regarded as having low to medium milking-ability. However, the breed has a remarkable organic resistance and adaptation to harsh and low-input systems. Previous reports concerning performance of the Turcana breed have shown milk production estimates ranging between 60 to 150 kg per lactation [3-5].

Starting year 2015, the Research and Development Station for Sheep and Goats from Caransebes of the Romanian Academy for Agricultural and

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Forestry Sciences began implementing a research project concerning organic dairy sheep farming. The main objective of the project is to explore and identify technical solutions to the specific constraints of organic dairy sheep farming linked to reproduction performances, feeding strategies and management, animal health and welfare. Aim of the current research was to evaluate the effects of the rearing system, organic versus conventional, on the reproduction efficiency when rearing Turcana sheep under extensive low-input conditions.

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 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.

The project flock consisted out of a total of 240 multiparous purebred Turcana ewes, with half of the ewes (n=120) being managed under organic rearing conditions and the control group (n=120) under conventional system, respectively. Rules that were met by the organic system are those stipulated by the Council Regulations of the European Commission (2092/91/EEC and 1804/99 EEC) on standards of organic animal husbandry [6, 7].

Ram/ewe ratio was roughly of 1:25, for three consecutive estrous cycles (50 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 organically produced on farm. Creep feeding of lambs was not practiced, they were solely reliant on the dams milk production. Lambs were weaned at 70±10 days of age. The

research activities were performed in accordance with the European Union's Directive for animal experimentation (Directive 2010/63/EU) [8].

In order to evaluate the potential of producing organic sheep milk in western Romania, under pasture-based extensive system, a comparative study between two pasture types was implemented. One managed and fertilized conventionally, and one organic managed pasture, which was subject to a conversion period of two years, 2012 and 2013.

The conventional 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%.

The organic pasture was fertilized in early-spring 2012 by direct grazing with the animals, at a stoking rate of 1 sheep/1.5 m², kept for four consecutive nights. After the animals removal from the pasture, minimum tillage works were done and the pasture was over-seeded using a mix of grasses and legumes having the following structure: *Lolium perenne* 40%; *Festuca pratensis* 30%; *Festuca arundinacea* 10%; *Lotus corniculatus* 10%; *Trifolium repens* 10%. During the conversion period, the pasture was used to produce hay, and not directly grazed by animals. More details regarding the pasture management are to be found published in Sauer et al. (2015) [9].

In Turcana ewes the milk yield (kg/lactation), conception rate (%), litter size (%), lambs survival rates (%) and litter weight gain at 28 days of age (kg) was recorded. Conception rate was calculated as the ratio between the numbers of ewes lambing relative to the total number of the ewes exposed to the ram. Litter size (prolificacy) was computed as the ratio between the numbers of lambs obtained relative to the number of ewes lambing. Litter weight gain at 28 days of age was calculated by subtracting the litter weight at birth from the litter weight at 28 days. Survival rates of lambs from birth to weaning were recorded. Milk production

of ewes was evaluated by using the ICAR B4 method.

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.

3. Results and discussion

Data regarding production and reproduction efficiency in Turcana ewes, under conventional and organic production systems are being presented in Table 1.

Turcana ewes reared under organic production system had on average milk yields of 78.95±4.59 kg of milk/lactation, while the ewes reared under conventional systems produced on average 76.81±2.99 kg/lactation. Although the milk production was slightly higher for the organically raised sheep, the differences were not statistically significant ($p>0.05$). As a result, current data suggests that the rearing system does not influence the production outputs in extensively reared sheep. Conception rates were on average of 96.6±0.84 % and 97.5±0.66 % in organic and conventional system, respectively ($p>0.05$). Results suggest that fertility related traits, such as the flock conception rates are not being influenced by the organic production systems, when compared to the extensive and conventional low input system.

However, the prolificacy was of 124.6±1.47 % for the organically reared ewes, and on average 118.3±1.23 % for the ewes reared under

conventional system. Prolificacy (litter size) was significantly influenced ($p\leq 0.05$) by the rearing system, with ewes raised under organic production having superior reproductive outputs.

Milking ability of dam ewes from lambing till 28 days postpartum, was of 4.86±1.44 kg on the organic flock and of 4.45±2.10 kg for the conventional reared animals ($p>0.05$). Results suggest that the milk production during the first 4 weeks after lambing is not being influenced by the type of the production systems, having in mind that the growth rate of the lamb(s) during the first weeks of their lives are exclusively related to the dam's milk and mothering abilities.

Survival rates of the lambs from birth till the age of weaning (70±10 days of age) were of 94.3±1.68 % and 95.7±0.33 % for the organic produced lambs and the conventional born ones, respectively ($p\leq 0.05$). Results have shown that the rearing system has an influence on the survival rates of lambs until weaning. As a result, farmers who consider changing their production systems to organic should be advised regarding the lower survival rates of the lambs found in the organic systems, as a result of restrictions when it comes to the use of antibiotics and vaccines.

Average daily gain in un-weaned lambs were on average of 164.8±3.33 g/day in organic group, and of 156.5±1.64 g/day in the conventional control group ($p>0.05$). It can be concluded that the growth rates of organically raised lambs are slightly higher, compared to conventionally raised lambs, however, there are no significant differences.

Table 1. Means (±SE) for production and reproduction efficiency in Turcana ewes, under conventional and organic production systems

Trait	Conventional	Organic	Differences
Milk yield (kg)	76.81±2.99	78.95±4.59	NS
Conception rate (%)	97.5±0.66	96.6±0.84	NS
Prolificacy (%)	118.3±1.23	124.6±1.47	*
Milk-ability (kg)	4.45±2.10	4.86±1.44	NS
Lambs survival (%)	95.7±0.33	94.3±1.68	*
Lambs growth rates (g/day)	156.5±1.64	164.8±3.33	NS

^{NS} $P>0.05$; * $P\leq 0.05$

Given the high production potential [10,11], in the European Agricultural Fund for Rural Development (EAFRD) programs for Romania,

the organic farming was set-out as a priority for local development, with several measures and types of funding's addressing investments in the

organic animal production sector and being available for the 2014-2020 period. Moreover, the Romanian sheep breeders should take advantage of the EU developed schemes such as PDO (protected designation of origin), PGI (protected geographical indication) and TSG (traditional specialty guaranteed). However, the low purchasing power of the local consumers and the consideration of the general public that the small ruminants production systems are environmental- and animal welfare-friendly, are the two main constraints for the future development of the organic sheep meat and dairy productions in Romania in particular, and Eastern Europe in general.

Results are in accordance with previous estimates regarding the production and reproduction parameters of Turcana sheep breed [4, 12, 13], for both the conventional and organic production systems.

4. Conclusions

Current results outline that the production system when dairy sheep are concerned, has an effect on the reproduction efficiency and on the overall farm returns, give that lamb production represents an important source of income in commercial farms.

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