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SHEEP AND GOAT NUTRITION IN THE ORGANIC FARMING SYSTEM

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Abstract: The nutritional needs of sheep and goats are influenced by body weight, breed, physiological stage, production level, activity, the number of lambs and kids, and environmental factors. Their diet, like that of other ruminants, is based on fibrous feeds. Concentrate mixtures made from organically produced feeds and permitted additives are also used as a supplement to the fibrous portion of the diet. Compared to other ruminants, sheep and goats utilize pastures most efficiently. Grazing, high-quality legume forage, and grass-legume hay are the dominant feeds in their diet (during the winter period, part of the hay can be replaced with silage). Compared to other ruminants, goats are better at utilizing coarser feeds.

Introduction

The production of a sufficient amount of healthy food for the growing number of inhabitants on the planet is one of the most important issues for the survival of modern society. One of the earliest predictions of a bleak future on this topic was made by Professor Jon Beddington, when in his work he stated the assumption that the increase in world population by 2030 will require a 50% increase in food production (Bedington, 2009). How important is food for an individual, but also for society as a whole, explained the famous sociologist Abraham Maslow, the creator of the "pyramid of needs". He pointed out that the need for food is the basic need of a person, and that first of all it is necessary to satisfy that need, and only after that all others (Maslow, 1954). Environmental protection and intensive agriculture are not interchangeable, and that is why organic agriculture is recognized as an important possibility in solving these significant problems in the world.

With the realization of the negative effects of intensive industrial agricultural production, as well as the consequences that consumption of products from the same can have from the aspect of consumer health (Laurence, 1991; Passille, 1997), interest in unconventional, especially organic, production is growing. All this has

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influenced that during the last decade, the volume of organic production on a global scale has increased significantly. Standards defined through laws and regulations that provide a framework for enabling good living conditions for domestic animals also contributed to the spread of organic production. These minimum standards, however, are not necessarily a guarantee for good conditions in terms of animal welfare and health (Sundrum, 2001; Kijlstra and Eijck, 2006). Organic agriculture is a management system that strives for environmentally and ethically acceptable, health-safe, socially just and economically viable agricultural production (Petrović et al., 2020, 2022, 2024). It is not only the production of high-value food and other agricultural products, but also implies a specific and high-quality attitude towards natural resources, their use in meeting food needs, as well as the economic viability and sustainability of production (Pavlović et al., 2011; Nikolić et al., 2013).

Sheep Nutrition

The nutritional needs of sheep are influenced by body weight, breed, physiological stage, production level, activity, the number of lambs, and environmental factors. Their diet, like that of other ruminants, is based on fibrous feeds. Sheep, compared to other ruminants, are highly efficient in utilizing pastures. Grazing, high-quality legume forage, and grass-legume hay are the dominant feeds in their diet (during the winter, part of the hay can be replaced with silage). Mountain pastures with diverse botanical compositions are particularly beneficial for feeding sheep during the vegetation period. During winter, hay from mountain pastures is used in their diet. Legume hay is recommended for feeding young and lactating sheep.

As a supplement to the basic diet, corn, sorghum, oats, and barley are commonly used. When grazing on high-quality legume pastures, additional protein supplements are not necessary. However, if the pasture is of moderate quality, protein supplements such as various oilseed cakes or legume grains are typically used. Sheep are well-adapted to utilizing lower-quality feeds, such as straw, chaff, and leafy branches. When using these feeds, the diet should be balanced by adding small amounts of high-quality hay, grains, and mineral and vitamin supplements. Suitable straw and chaff include those from oats, millet, barley, and wheat. Chaff is typically mixed with succulent feeds or moistened and mixed with concentrates.

Leafy branches from birch, linden, ash, beech, and hornbeam, collected during June and July, are ideal. The quality of well-prepared leafy branches is comparable to that of lower-grade hay.

The feeding level before and during the mating season is based on the body condition, assessed by palpating the lumbar region of the spine and assigning scores from 1 to 5 (Kellems and Church, 1998).

The nutritional needs of pregnant sheep can be met with high-quality fibrous feeds. With medium-quality fibrous feeds, pregnant sheep require additional concentrate feeds. Poor-quality fibrous feeds, even with the maximum allowable amount of concentrates, cannot meet the nutritional needs of sheep carrying twins.

During early spring, grazing on grass-legume pastures can fully satisfy the needs of pregnant sheep carrying twins. Dividing sheep into different feeding groups and continuously monitoring their body condition can reduce the consequences of both overfeeding and underfeeding. Examples of meal structure in sheep nutrition (Čengić-Džomba, 2014):

Dried sheep, early stage of pregnancy:

- good grass or grass-leguminous pasture
- good grass or grass-leguminous hay (1.5-2 kg)
- alfalfa hay (2 kg)
- corn silage (2.5-3 kg) + protein supplement (0.1-0.12 kg) + animal chalk (0.018 kg)
- good leguminous hay (0.9-1.2 kg) + corn silage (1.3-1.6 kg)

Ewes in late pregnancy (last 4-6 weeks):

- the meals are the same as the previous ones with the addition of 0.3-0.5 kg of grain

Lactating sheep:

- good grass or grass-leguminous pasture (if the grazing is exclusively grass, limited or if the sheep are nursing two lambs, add 0.5 kg of grain)
- good grass or grass-leguminous hay + 0.5-0.7 kg of grain
- good grass hay (2 kg) + 0.1 kg of protein supplement + 0.5-0.7 kg of grain
- corn silage (2.5-3.5 kg) + 0.1-0.2 kg of protein supplement + 0.5-0.7 kg of cereals + 0.018 kg of fodder chalk
- good leguminous hay (1 kg) + 1.5-2 kg of corn silage + 0.1 kg of protein supplement + 0.5 kg of grain

Sheep in the season of allowance:

- adding concentrates (primarily energy) to meals

Lambs:

- hay grass or leguminous pasture + corn + soybean cakes or dehydrated alfalfa + salt + animal chalk

Goat Nutrition

Similar to cattle and sheep, goat nutrition is based on roughage. Dry matter intake largely depends on milk production and the body weight of the goats. Dry matter consumption increases after kidding and reaches its peak in the second month of lactation. For example, goats with a body weight of 50 kg producing 3 kg of milk consume 2.11 kg of dry matter per day, while goats of the same weight producing 6 kg of milk consume 3.03 kg of dry matter per day (Grbeša et al., 2005). As milk production decreases, so does dry matter intake. Goats are selective when it comes to food. During the vegetation period, grazing is implied. It is recommended that grass-legume mixtures consist of legumes and grasses in a 1:1 ratio (alfalfa and timothy grass). Goats are highly sensitive to mycotoxins. Compared to other ruminants, goats utilize coarser feed more efficiently. If available, foliage from deciduous trees (oak, ash, cornelian cherry, etc.) and conifers is desirable in goat nutrition.

The basis of winter feeding includes hay, corn silage, and root crops. Silage replaces part of the hay during winter feeding. The main energy sources are corn and barley, while protein sources typically include legume grains and oilseed cakes. Feeding solely on grass hay requires the addition of protein-rich feed. Concentrate mixtures made from organically produced feed and permitted additives are also used to supplement the roughage portion of the diet. Minerals, vitamins, salt, and water should be available in optimal quantities.

Table 1. Quality and structure of concentrates in goat nutrition depending on the quality of voluminous forage (Čengić-Džomba, 2014)

***Type of* voluminous forage**	**Concentrate supplement for high-producing goats** (over 3.5 kg milk/day)	**Concentrate supplement for low-producing goats** (below 3.5 kg milk/day)
15% PC excellent legume hay or excellent quality pasture	14% **PC**	12% **PC**
12-15% PC mixed legume hay and good quality grass or pasture	16% **PC**	14% **PC**
10-12% PC good hay grass or pasture of medium quality	18% **PC**	16% **PC**
Below 10% PC medium quality hay or poor pasture	20% **PC**	18% **PC**

PC- Protein content

By selecting an adequate breed, optimizing the system for using bulky feed, and providing proper housing, goats that produce up to 500 kg of milk during lactation can meet all their nutritional needs from high-quality bulky forage. For higher milk production, it is necessary to add concentrate feed to their diet. Producing around 500 kg of milk per goat during lactation is possible with a diet comprising 80% bulky forage (pasture, alfalfa hay) and 20% concentrate feed. The protein content in the concentrate supplement ranges from 12% to 20%, depending on the quality of the bulky portion of the diet (Table 1).

Examples of diet structure in goat feeding (Čengić-Džomba, 2014):

Goats during the mating period:

- Adding concentrates (primarily energy-rich) to the bulky part of the diet or providing very high-quality pasture.

Goats in mid-pregnancy:

- High-quality pasture or hay, and if grains are included, the maximum amount should be 100 g/day.

Last six weeks of pregnancy:

- Adding grains (300-700 g/day) to the diet, especially if the roughage is of poor quality or if the animal has previously given birth to multiple kids per litter.

Lactating goats:

- Generally speaking, roughage is not sufficient, especially if the goat is nursing multiple kids. The diet should contain 14-15% crude protein. The amount and type of concentrate feed depends on the quality of the roughage.

Feeding kids:

- Along with milk, kids should be given about 100 g of concentrate containing 16% crude protein. After weaning, the amount of concentrate should be increased to approximately 200 g, regardless of the quality of the roughage.

Feeding bucks:

- Outside the breeding season, only high-quality pasture or other coarse feed is needed. During the breeding season, concentrated feed should be added to the roughage. The protein content in the diet should range from 12-14%.

Conclusion

The growing awareness of ecosystem disruptions and the vulnerability of living organisms as a whole has imposed the need to reconsider previously applied technologies and methods in order to accelerate production growth in all human activities, including agriculture. Despite the fact that a large number of various domestic animal species are reared around the world, the objective risk of their rapid extinction due to a decrease in adaptive capacities is increasingly recognized.

The advantage of organic production in sheep and goat farming is to mitigate the negative effects of social development on the ecosphere and humanity as a whole. Organic production can meet all the requirements in terms of environmental protection and welfare in the breeding of various breeds and categories of sheeps and goats, providing real opportunities for development in our conditions. It is important to note that one of the most significant characteristics of organic sheep and goat production is the integration of crop and livestock farming.

Based on the above, it can be concluded that underdeveloped countries must seek development opportunities in areas where they have natural potential, opportunities for adhering to the principles of sustainable development and environmental protection. For Serbia, the concept of organic sheep and goat production represents such an opportunity.

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