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Recent developments in goat nutrition and application: A review☆

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Abstract

This paper analyses the progress in recent research in goat nutrition since the last International Conference on Goats (Tours, 2000). This review reveals clear progress in the quality of papers, now similar to those on cattle or sheep, particularly on nutritional aspects in tropical areas. Topics dealt with in goat nutrition are feeding behaviour, particularly on pastures or rangelands, feed digestibility, tree leaf or by-product utilization, effects of nutritional factors on growth, milk and hair production, while nutritional adaptation to harsh environments, underfeeding, factors influencing energy consumption, quality of goat products (milk, cheese, meat) and reproduction performance along with the connection between nutrition and pathology require more attention. Goat nutrition in a tropical environment follows the same physiological mechanisms as under temperate conditions, but genotypes can present specificities enabling a better adaptation to feeding conditions. Complete and precise information on the nutritive value of tropical forage, rangeland vegetation in accordance with the season, and new feed or by-products is still missing. Researchers in goat nutrition frequently use different methods, making it difficult to compare results from several research teams. Agreement on the methodology in goat nutrition is easier when the research teams are organized in networks at the national or international level. To be successful with technological transfer in goat nutrition, the message for the end users must be clear and well adapted. At the present time, we are short of review papers that provide an analysis of all results already published to establish quantitative relationships between variables, which can clarify the messages for the field. Methods of meta-analysis can be used to analyse the quantitative results from experimental data banks and to establish response laws and define limits of application. Finally, if we implement a research project on goat nutrition dedicated to application in the field, not only the research works but also the actions of technological transfer must be financed.

Keywords: Goat nutrition; Intake; Nutrition application; Feed utilization; Goat product quality; Research efficiency

1. Introduction

Nutrition plays an essential and special role in the systems of goat farming for the following main reasons. First, it is the production factor that goat farmers or keepers can act on the most easily and rapidly (amounts

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of feeds, composition of diets, on-pasture goat management). It has the most marked effect on production costs (from 50 to 85% of the total cost for milk production under European conditions (Ouin, 1995), and accordingly on farmer incomes. Furthermore, the management of feeding in goat flocks depends on vegetal mass production and rangeland, pasture and crop by-product management. Feeding directly impacts the other components of systems of goat production, such as pathological conditions and the reproductive performance of flocks. Moreover, a nutritional program for goats must always be established by taking into account the genetic characteristics of the breed or genotype used (potential of production, ability for adaptation, etc.)

Until around 1970, research on goat nutrition was limited and late in comparison with the knowledge already obtained in cattle and sheep. As the economic interest in goat farming was diminishing and goats were being accused of deforestation and desertification, little research was carried out to solve goat farmers' practical questions. On the one hand, scientific research of excellent quality used goats as experimental animal model on subjects concerning, particularly, physiology of behaviour, metabolism, digestion and secretion of milk in ruminants (amongst the most famous references: Linzell, 1960; Anderson and Larsson, 1961; Armstrong and Blaxter, 1965). On the other hand, there were a lot of books and booklets on goat farming where information was difficult to verify, and sometimes some preconceived ideas on goats were regenerated by successive authors. Before 1970, French (1970) observed in his reference book: 'Observations on the Goat' that "... the literature on the goat abounds in the most unfounded ideas concerning its feeding habits". He was one of the first authors to try to synthesize knowledge on goat nutrition to facilitate objective and useful application of information in the field.

After the political events around 1968, which were the first criticism of productivism and the affluent society, the image of goat farming improved. People rediscovered goats as ecological animals and the socio-economical role of goats in many tropical countries (Morand-Fehr and Boyazoglu, 1999).

At the outset, developed countries were the leaders in research on goat nutrition as 45% of the research on goats was carried out by these countries which had only 5% of the world's goat herds (Morand-Fehr, 1996). But for the last 20 years, research on goat nutrition has been developed to obtain results that can be applied in the field, particularly in developing countries. Several chapters dedicated to nutrition included in books on goat farming (Gall, 1981; Devendra and Mc Leroy, 1982; Coplan, 1985; Galbraith, 1992), invited reports in the Proceedings of Conferences or Symposia (ITOVIC-INRA, 1981; ICG, 1982, 1987, 1992, 1996, 2000) or scientific books on goat nutrition (Morand-Fehr, 1991; AFRC, 1998; Dronchner et al., 2003) have pooled and generated scientific and objective knowledge on goat nutrition and its application possibilities.

However, even if progress on this topic has been rapid, research on goat nutrition remains more limited than in cattle and sheep, and very poor in certain aspects.

Under the current conditions, it would be interesting to review the most recent progress on goat nutrition, to analyse the possibilities of transferring these results into various practical conditions as well as to suggest ways of improving the quality of research on goat nutrition and to use its results efficiently in the field. Indeed, the observation from Devendra and Mc Leroy (1982) that "little attention has been paid to the goat feeding in the past so that relatively low inputs to improve feeding could produce relatively high gains in productivity" remains true, even if progress has recently been achieved.

The aim of this paper is to objectively analyse the progress and advances of recent research works dating back to the last International Conference (ICG, 2000), particularly as concerns developing countries where the possibility of applying research results in the field is essential. We have decided to comment only on those papers that complete the research noted in preceding papers, or have brought about new advances in goat nutrition even if our choice risks to be a little arbitrary.

2. Present situation of goat nutrition

2.1. Feeding behaviour

The level of intake and the characteristics of digestion depend closely on the feeding behaviour in goats reared in the goat house, on pastures, on rangelands or under very harsh conditions. The feeding behaviour at trough has already been described thoroughly by Morand-Fehr et al. (1991a) and Morand-Fehr (2003a),