Introduction

The scarcity of animal feed in winter is a universal concern in livestock development strategies for the hill/mountain areas, especially in tropical and subtropical countries where the vegetation growth is largely determined by a single, short- duration monsoon season. The feed deficit problem is further accelerated by the rapidly deteriorating natural resources caused by intense population pressure, a high degree of deforestation, desertification of pastureland, lack of proper forage, and lack of pasture development strategies suitable for the third world. Generally, the main land resources for animal feed can be categorised into four types: (a) native rangeland, (b) forestland, (c) wasteland, and (d) cropland. The former three land resources are degrading to such an extent that their ability to supply forage for animals decreases annually. On the other hand, the cropland provides enormous amounts of fodder, grasses, and crop residues. The crop residues include straw and stover from crops such as paddy, wheat, oats, millet, maize, and sorghum which are used extensively as animal feed. Apart from this, the cropland provides a wide range of cereal brans and oilseed cakes which form the principal ingredients of compound animal feed.

Ruminants are efficient at drawing nutrients from fibrous feed, and this is a result of the activities of rumen microbes. These animals with their stomachs divided into four compartments, namely, rumen, reticulum, omasum, and abomasum, are regarded as the digesters of the huge quantities of cereal straw, native pasture, and several other industrial by-products and wastes which have otherwise no commercial value. These crop residues are easily digested and are characterised by low levels of nitrogen and other essential nutrients; hence their limited use as a complete diet. However, in the foreseeable future these crop residues will play a much important role in satisfying the demands for animal feed. Therefore, the agricultural planners of developing countries face the challenge of how to make rational use of these feed resources with minimum dependency on foreign inputs in the crop-livestock production system. This type of production system is aimed at creating a sustainable farming system in which the local resources will be efficiently mobilised and, at the same time, maximise the degree of self-reliance within the village economy.

It is well-documented that, when fed on a residual straw diet, a significant increase in ruminant productivity is now possible with proper supplementation practices that create optimum conditions for maximum microbial outputs. The basic strategy for supplementation with the use of cereal straw is to provide the most abundant and inexpensive source of nitrogen and fermentable carbohydrates to the rumen microbes so as to maximise the fibre utilisation efficiency in the rumen. Several attempts have been made to improve the feed value of straw. Pre-treatment of paddy and wheat straw has been carried out in several countries (e.g., India, Bangladesh, and Sri Lanka) using fertilizer grade urea which is a cheap source of nitrogen. Recent developments have made it possible to improve the value of straw as ruminant feed by using cane molasses as a carrier for urea and other food nutrients in the form of urea molasses nutrient blocks.

Semi-liquid molasses, a by-product of sugar factories, is extensively used as animal feed in many parts of the sugarcane growing areas of the world. Mixtures of semi-liquid urea molasses have been successfully distributed among Ethiopian farmers as a survival ration for cattle during droughts (Preston and Lewis 1984). In recent years, FAO has been assisting several countries in Africa to manufacture and distribute urea molasses blocks under village conditions (Sansoucy 1986). In India, the National Diary Development Board (NDDB) has taken the leading role in disseminating nutrient block technology among cooperative farmers. The NDDB (1982/83) has accepted the new approach of feeding nutrient supplementation to ruminants in the form of urea molasses mineral lick, consisting of urea molasses, protein, and minerals. A manufacturing plant has already been installed at the cattle feed factory - Kaira District Dairy Cooperative, Anand, India, for the production of nutrient blocks, popularly known as *"Amul-U-Min"* among cooperative dairy farmers. *"Amul-U-Umin"* is a hard block weighing three kilogrammes. It can be kept in the manger so that animals can lick it whenever they wish. Feeding on this "*Amul-U-Min*" at will has stimulated the intake of straw by 30 per cent reducing the concentrate feed intake by 40 per cent, without losses in milk yield or body weight (Kunju 1985). The introduction of the nutrient lick (with an average intake of 500 g/day/ha) increased milk production from 1.5 to 2.4 with a substantial increase in milk fat (Kunju 1986).

In milk-producing areas, where large amounts of concentrate feed (4-6 kg/d) were fed to dairy buffaloes, the use of the nutrient blocks allowed the farmers to reduce the amount of concentrate feed by two to four kg/d thereby increasing the profitability (NDDB 1982/83). Currently, urea molasses' lick is being used successfully by Gujarat farmers as a multi-nutrient lick for dairy buffaloes and bullocks. In fact, this kind of nutrient block has been commercially produced and distributed among the dairy farmers in India and about a 10 to 25 per cent increase in milk production has been recorded (Kunju 1986). More countries are examining the usefulness of the technology within the existing animal feeding system. However, no literature has described the formulae, cost, and methodology of nutrient block preparation. In Bhutan, efforts have been made recently to prepare an ideal type of nutrient block for ruminants by moulding cane molasses, urea (fertilizer grade), cereal bran, oilseed cake, and minerals into a solid brick size block, known as **Urea Molasses Block (UMB).**

It is intentionally made sufficiently hard in order to regulate a consistent level of intake when animals lick on it. It is palatable to farm animals and provides essential nutrients such as energy, protein, non-protein nitrogen, and minerals to the rumen microbes for better digestion of fibrous materials. The overall result from field demonstrations on UMB supplementation in Bhutan suggested that the technology was a cost-effective approach to maximising the use of locally available feed resources for better animal production.

The primary objective of this paper is, therefore, to explore the relevance of Urea Molasses Block as a feed supplement to ruminants, based on the experiences and the technology developed in Bhutan. It is also intended to deliver the information on the potential use of the technology in achieving sustainable improvement in the nutritional status of livestock in the HKH Region. This paper also deals with the basic preconditions and infrastructure needed to develop a UMB, with special emphasis on the prevailing conditions in Nepal.