Replication Possibilities in Nepal

Nepal is considered to be a country with a high density of livestock population per unit of land area. The majority of the population (more than 90%) earn their living from agriculture and are distributed in the mountains, the hills, and the *terai*, with an estimated distributional figure of 8.6 per cent, 47.7 per cent, and 43.7 per cent respectively. Only 17 per cent of the total land is brought under cultivation of which about 39 per cent and 56.5 per cent of the cultivated land lie in the hills and the *terai* respectively. It has been reported that there are about 5.4 million livestock units in the country, of which about 11.1 per cent, 51.9 per cent, and 37 per cent are in the mountains, the hills, and the *terai* respectively (Shrestha and Sherchand 1988).

Feed for Livestock

The total livestock population requires about 8643.4 thousand metric tonnes (MT) of the total digestible nutrient (TDN) for a minimal level of nutrition. This would pose a demand of about 1,071, 4,316, and

2,354 thousand MT of TDN by ruminants in the mountains, the hills, and the *terai* respectively. The total availability of livestock feed in the country is estimated to be about 5589.6 thousand MT of TDN, of which about 37 per cent of the total is derived from cereal crop residues and by-products alone. It is also indicative that cropland contributes 24 per cent and 37 per cent of the total requirements and availability of livestock feed in the country respectively (Table 9).

Table 9: Contribution of Cropland to Ruminant Feed

TOTAL	Mountains	Hills	*Terai*
1. Cultivated land, 2.3 million hectares	(4.1) (0.1)	(39.1) 0.9	(56.5) 1.3
2. Livestock units, 5.4 millions	(11.1) (0.6)	(59.9) 2.8	(37) 2.0
3. Total feed requirements, 8643.4 x 1000 MT of TDN	(12.4) 1071.9	(49.9) 4316.7	(37.7) 2354.8
4. Availability of feed, 5589.6 x 1000 MT of TDN	1240.7	2029.5	2319.5
5. Feed balance, 3053 TDN x 100 MT	+ 168.8	- 2287.3	- 935.4
6. Contribution of cropland to the total requirement of feed, 2085 x 1000 MT of TDN	(6.5) 70.9	(14) 602.3	(60) 1411.8

The total production of paddy, wheat, millet, and barley was estimated at 4,323 x 1000 MT in 1988/89 (Central Bureau of Statistics, Nepal, [CBSN] 1990), which gave about 4,323 x 1000 MT of crop residues, assuming the minimum proportion of grain to straw to be 1:1. If the utilisation of cereal straws for animal feeding is estimated to be 70 per cent of the total, it will provide about 1000 x 1,000 MT of TDN which will be enough to maintain two million LUs for seven months.

Sugarcane tops and maize stover are also considered important feed for ruminants in many parts of the country. Sugarcane as a cash crop is well-known and produces the highest amount of biomass among all cultivated crops. The total sugarcane production during 1988/89 was estimated at 900 x 1,000 MT (CBSN 1990) and a large portion of this was used by sugar factories. A significant amount of sugarcane tops are used for animal feeding, although these are highly fibrous and contain a negligible amount of nitrogen. Many working animals are fed on cane tops for several months a year in the plains. The work performance of these animals can also be improved by nutrient block supplements.

It is claimed that about three per cent cane molasses can be obtained from processed sugarcane stalks. This gives a figure of about 27 x 1,000 MT of molasses 900 x 1,000 MT of sugarcane which is equivalent to 20 x 1,000 MT of maize and almost equal to the total quantity of wheat bran produced in the country. The other feed ingredients, such as cereal brans and oilseed cakes, are locally available and fairly distributed throughout the hill and the *terai* regions. Traditionally, the cereal grains and oilseed cakes were used as concentrate supplemental feeds for estimated production of oilseeds in 1988/89 was about 99 x 1,000 MT. From this figure it can be calculated that more than 50 x 1,000 MT of oilseed cakes are available in the country. However, the extent to which these agro-industrial by-products are used in animal feeding has not been studied in detail.

Molasses in Livestock Feeding

Molasses are the by-product of sugar factories and are the only available source of readily fermentable carbohydrates that are widely available in the tropics. Historically, they are not a part of the human diet and are largely used in distilling alcohol (rum). The lack of technical knowhow regarding the efficiency of molasses in animal feeding has resulted in waste which are often discarded in rivers. However, the recent developments concerning the potential of molasses have indicated that the use of molasses in animal feed could be profitable and economically superior to its use as a raw material in alcohol production.

Molasses are widely used in feed compounds in the developed countries to improve the palatability and binding nature of pelleted feed. It is also used in reducing the dustiness of commercial animal feed. The inclusion rates of molasses in concentrated feed are at low levels (5% to 10%) because they increase the moisture content in the final product. Nevertheless, molasses are widely available in the country compared to other feed ingredients. The importance of molasses in terms of the their use are enumerated below.

a) As a major source of fermentable carbohydrate in ruminants' diets.

b) As a palatable carrier for urea and minerals to improve the use of fibrous and low nitrogen diets.

c) As a survival feed for ruminants during periods of feed scarcity, especially in winter.

d) As a binding agent to improve the dusty nature of compounded livestock feed.

Currently, molasses are used only in commercial feed mills in the country to improve the palatability and dusty nature of commercial livestock feed. The other ways and means of efficient use of molasses for production purposes have not been tried yet to any appreciable extent. The reason behind this limited use of molasses in animal feed can be attributed largely to the lack of technical knowhow in field conditions, rather than the complications and limitations arising from the indigenous farming system of the country. The traditional as well as the currently ongoing farming systems in Nepal are highly integrated with crop, livestock, and forestry systems, with an ultimate goal to optimise the overall agricultural and livestock productivity from the available resources by growing multipurpose crops, rearing multipurpose livestock, and recycling residues and by-products as nutrients for farm animals as well as for plants. Therefore, there is an unlimited prospect for the development of UMB in Nepal where many of the prerequisite conditions for successful application of the UMB technology are present as can be seen by the existing feed resources, types of farm animal, level of farmers' skills, climate, and the ecological conditions of the country.

Socioeconomic Conditions of Farmers

Most ruminants are owned by small farmers having less than 0.5 hectares of land. The size of landholdings in the hills is smaller than in the *terai*. The average family size of an average Nepalese farmer in the hills of Nepal is six persons with a livestock holding size of 2.4 cattle, 1.2 buffaloes, and 2.2 goats/sheep. This indicates that he must first earn enough food for his six family members then only he can think of improving the conditions of the livestock he owns. It was also reported that an average household produces a little more than 800 kg of cereals from about 0.49 ha of land (Shrestha and Sherchand 1988). This amount of cereal production also gives about 500 kg of cereal bran and about 1,500 kg of crop residue. The overall picture reflects that a normal household would be able to produce food to meet family needs for about five to six months in a year and for the rest of the time it would have to rely on external sources. Part of his daily household cash requirements can be met by selling one to two litres of milk from livestock raised on available pasture and on crop residues. The crop residues received from half a hectare of land would hardly be enough to meet the voluntary intake of his household livestock even for two to three months. For the rest of the winter farmers have to depend on community grazing land, forest, fodder trees, and cut grasses which, in most circumstances, are rare commodities for a small farmer.

A large part of the winter feed is provided by cereal straws and mill by-products in the *terai* where the average landholding size is about 1.7 hectares (about 70% larger than in the hills). In the above context, the conditions in high altitude areas is poor mostly because of the rugged and steep topography. Many data on the village economy and farming constraints are unknown. However, it has been reported that there is heavy livestock pressure in the high mountains with an estimated stocking rate of 0.48 LU/hectare of land and a large livestock holding of about 8 *yak*, 5.1 cattle, and 6.7 goats/sheep/ per household. Most of 'these livestock are migratory flocks which are grazed on alpine meadows and on rangelands. In recent decades, the productivity of these feed resources has declined continuously as a result of heavy soil erosion and deteriorating ecological trends. Nevertheless, during the dry season all of these feed resources, whether they are from native rangelands or are cut grasses or crop residues, are made up of highly fibrous contents with insufficient nitrogen to provide the ammonia needed by the rumen microbes for efficient fermentation. In the above situation, supplementing ruminant animals with urea in the form of UMB can bring about marked improvements in production as well as increased survival rates during winter scarcities.

Prospects of UMB Adoption among Nepalese Farmers

Almost all farmers do have a limited cash income and a large part of it is usually invested in household commodities. The foremost preference of a farmer is to ensure a food supply for his family. Afterwards he will mobilise his finances to purchase farm inputs such as fertilizers, insecticides, improved seeds, medicines for animals and plants, farm tools, and animal feed. Supply of these inputs is subject to socioeconomic constraints or lack of constraints. Hence the prerequisite for technical innovation, if it is to be successful, is that financial returns must ensue from capital investment within a short period of time.

In this context, several village level studies have shown that the provision of UMB supplements is a cost-effective input in dairy husbandry. Feeding UMB (10% urea) to cows in the village of Khaira District, India, resulted in a net saving of about Rs 250 (Indian Currency) per day (Kunju 1985). In a village in Bhutan, UMB gave a net return of about *Nu* 1.45/day through a 26 per cent increase in milk production from cows fed on a straw diet. The cost of UMB was 4.64 *Nu*/kg and that of the milk was 7 *Nu*/kg at the time of the study (1990). The study was conducted in the southern hills of Bhutan (Tala village) at an altitude of about 5,000 ft and accessible by gravel road. The climatic and topographical conditions of Tala village are similar to those prevailing in the mid-hills of Nepal.

It is envisaged that the cost of UMB production is much cheaper in Nepal than in Bhutan, since all the ingredients needed to manufacture UMB are available in Nepal, whereas in Bhutan almost all of the raw materials have to be imported from India and Nepal. Based on the above facts, a remarkable improvement in the net saving could be achieved through adopting the UMB feeding practice for dairy cattle. In the case of farm animals, other than lactating or draft animals, the immediate impact of UMB feeding may not be always detectable because the response to UMB supplements in terms of growth rate and draft power is difficult to measure quantitatively in field conditions.

Another characteristic of the UMB feed is that it is simple to handle and does not demand extra time from farmers and neither does it interfere with normal farm activities. All that is required is to leave the UMB in the feeding trough or to hang it within the reach of animals at all times. The application of UMB is not hazardous and almost free from risk, e.g., from urea toxicity. When the animals lick it, a continuous supply of fermentable carbohydrate (through molasses) helps the effecient use of ammonia (relecesed from urea) by microbes in the rumen without the absorption of free ammonia molecules into the brain of the animal. Furthermore, the feeding of UMB to ruminants does not conflict with any religious and cultural taboos.

Past experiences suggest that it is not easy to implement scientific innovations in livestock production at the village level, because it is quite a difficult task to convince small farmers to accept innovations, particularly when the farmers have to buy the farm input themselves. However, as long as the innovation has the ability to generate a marginal return from its application, farmers do adopt them; they are practical enough to carry out their own financial analyses before accepting any new technology.

Another critical problem is the difficulty in disseminating information on the new technology among large numbers of targetted farmers. The reason behind this are many and varied. The communication barriers among small farmers are further aggravated by the poorly developed transport and institutional infrastructures in many developing countries, and Nepal is no exception. In recent years, noticeable developments have been taking place in the field of transport and communications. For example, the total length of roads increased remarkably from 624 km in 1956 to 7,007 km in 1989, but only about 28 per cent of the roads are connected to districts and villages, of which more than 89 per cent are not suitable for trucks during all seasons. In high altitude areas, the means of transportation are limited to human porters and pack animals. Household commodities, such as food crops and salt, receive first priority for transportation and it is unlikely that remote area farmers will agree to transport secondary commodities such as insecticides, propagated seedings, or medicines for animals. The same applies to UMBs, unless handsome incentives are provided by some government or external institution. Therefore, it is too early to expect a high level of diffusion of UMB technology in the high mountain areas, not only because of poor transportation linkage but also because many livestock production functions as well as the local constraints are not adequately understood. In the rest of the country, there seems to be a great potential for UMB technology, especially in the milk-producing pocket areas of the hills and the *terai*.

It has been proved that the longer-term consequences of the transfer of technology from developed to developing countries has led to ultimate dependency on foreign inputs of superior animals and farm inputs to attain sound benefits from the transferred technology. Although the concept of nutrient blocks originated from the developed countries, its basic field technology field has been developed mostly in countries of Africa and Asia having similar socio-ecological conditions and livestock production constraints. The most important features of UMB technology for Nepal in terms of self-reliance are listed below.

(1) Adequate availability of raw materials for the preparation of UMB within the country.

(2) The UMB itself is made up of urea and agro-industrial by-products which are required for efficient utilisation of crop residues and low quality roughage; the only winter feed resources available for ruminants not only in the *terai* but also in the hills and the mountains.

(3) Feeding UMB to ruminants will help create a better environment and bring about a sound improvement in indigenous breeds, village farming systems, and available feed resources which have been seriously neglected so far.