Development of UMB in Bhutan

For the first time in Bhutan, Mittel et al. (1985) prepared about 11 types of sun-dried urea molasses' blocks incorporating various levels of calcium hydroxide as a binding agent. Growing steers and lactating cattle, fed on straw-based diets, found this palatable. In the same year, a feeding trial was conducted on growing Jersey cross-bred calves, fed on paddy straw, to investigate the effect of UMB supplements on live weight gain. A positive weight gain was reported (not quantitatively indicative) among growing calves with a daily intake of about 239 grammes of UMB, and no deleterious effects from urea toxicity were reported throughout the UMB supplementation period (Premasiri 1985).

From these findings it was claimed that UMB supplements improve the overall performance of growing cattle on straw diets. However, there was a major drawback in the unit cost of the UMB (10% urea) which was prepared with eight per cent calcium hydroxide as a hardening agent. The above mentioned

batch of workers used the same type of UMB formula, and this resulted in a cost of about 40 *Ngultrum** per kilogramme of UMB in which more than 80 per cent of the ingredient's total cost was attributed to the binding agent alone. The excessively high cost of the UMB was the major failure in implementing the UMB technology in field conditions. Initially, the UMBs were prepared with 10 per cent calcium hydroxide, making the block hard, but it turned out to be very expensive. Later on, they prepared several batches of UMB with different proportions of calcium hydroxide. It was noticed that the incorporation of the hardening chemical at a rate of less than eight per cent of the total die did not give rise to a sufficiently hard UMB. Both batches of workers prepared the UMB at the farm itself and dried them in the sun, requiring more than ten days. In the later preparation of UMB, different levels of bentonite, calcium hydroxide, and cement were used as an alternative inexpensive binding agent but none of them reduced the cost of UMB to an appreciable extent. Hence to find an alternative inexpensive means for preparing hard UMB was of great concern. The determining factor for the practical use of UMB lies in its hardness which controls over-consumption of the block while animals lick it. The UMB contains fertilizer grade urea as a source of non-protein nitrogen and, when animals lick it, the urea breaks down into ammonia in the rumen. The ammonia is rapidly taken up by the rumen microbes for multiplication of the microbial population. However, an excess consumption of urea as a result of a soft and loose type of UMB could lead to urea toxicity in ruminants. Therefore, an ideal UMB should be hard enough regulate the level of intake by animals.

Preliminary Work on the Preparation of UMB

In early 1988, the Department of Animal Husbandry showed a keen interest in the utilisation of local resources to prepare animal feed, with a special emphasis on solving the feed scarcity problem in the high altitude areas of the country. In the same year, several visits were made to the Feed Mixing Plant where a number of urea molasses' mixtures were prepared and tested for their firmness without the use of chemical binding agents.

A paddy blade mixture was used in the ingredients in order to obtain a homogeneous urea molasses' mixture. To start with, several batches of 50 kg urea molasses' mixture were prepared using different qualities of feed ingredient; the main three types of UMB are shown in Table 1.

Characteristics of each ingredient were carefully studied for their roles in contributing to the hardness of the final mixtures. It was observed that the inclusion of molasses having 24 per cent moisture content gave better firmness to the mixture than molasses having 44 per cent moisture. It has been noted that the inclusion of course types of wheat bran gave more hardness to the mixture than the inclusion of fine types of wheat bran. These characteristics of cane molasses and wheat bran, which represent about 62 per cent of the total UMB mixture, were largely neglected during previous studies.

Ground and cooked oilseed cakes were introduced into the urea molasses' mixture in order to provide some rumen by-pass proteins to improve the levels of animal production. Normally, about 50 per cent of the total protein content in *Til* cake is by-pass protein. This proportion of by-pass protein can be raised to as high as 60 per cent in heat-treated *Til* cakes. This is the reason why the *Til* cake was cooked up to 60° C before mixing it with the rest of the UMB mixture. The inclusion of up to 12 per cent of oilseed cakes gave an exceptionally hard and firm consistency to the final UM mixture which could not be achieved in the previous mixture prepared without mixing the chemical binding agent. Another noticeable change in the viscous nature of the UM mixture was that the block could be lifted up and transported to another section immediately after moulding. In this way the same moulding block could be brought into use to prepare other batches of UMB. These characteristics were essential in order to make this a commercially viable technology for the production of UMB.

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* *Nu:* Bhutanese Currency equivalent to the Indian *Rupee*

Table 1: UMB with Different Ingredient Mixes

Ingredients/types	1	2	3
* Cane molasses	45	45	40
** Wheat bran	28	28	22
*** *Til* cakes (Sesame oil cake)	-	-	12
Urea	10	10	9
Cement	12	12	12
Cost in *Nu*/Kg	2.40	2.40	2.48
Water	+	+	+

* Molasses of 44 per cent moisture in Type No. 1 and 24 per cent in Types No. 2 and 3.

** Fine wheat bran in Type No. 1 and coarse wheat bran in Types No. 2 and 3.

*** *Til* cake ground and cooked up to 60° C.

\+ More than three litres of water for 12 kg of cement.

Cost of ingredients in *Nu*/kg at the time of preparation (1989)

(1) Cane molasses = 2.5,
(2) Wheat bran = 2.7
(3) Urea = 2.25
(4) *Til* cake = 3.25
(5) Cement = 2.0 and
(6) Salt = 1.0
(1 *Nu* = 1 Indian *Rupee*)

In addition several other changes were made in the internal characteristics of the individual ingredients and in the processing techniques to achieve a low cost and a sufficiently hard UMB without the use of chemical agents. The role of the cement was to provide a consistent hardness to UMB. It was initially used to replace the expensive binding agent. The inclusion of cement in the UMB has virtually no significant nutritional value to ruminants. At the same time, it has no ill effect on animals as long as it represents less than five per cent of the total dry matter intake. The other ingredients, such as fertilizer grade urea and common salt, were included as an inexpensive source of non-protein nitrogen and minerals for the UMB mixture.

There was no significant difference in the total cost of ingredients among the three types of UMB mixtures. The mixture with *Til* cake was found to be the best among the three mixtures in terms of firmness at the time of moulding. A few of these moulded blocks were taken to the Feed Analytical Laboratory for chemical analysis. Some of the blocks were dried in the sun, and this also made them sufficiently hard, but this drying process took a long time and was a laborious task that depended upon the weather. Some of the moulded blocks were partly dried in the oven at low temperature (60° to 65°C) for 18 hours. This reduced the moisture content of UMB from 25 per cent to about 13 per cent, and interestingly, the partly-dried UMB turned out to be exceptionally hard and was comparable to that prepared by using eight per cent of calcium hydroxide.

It was necessary to monitor the cost involved in the oven treatment of UMB in order to compare it with the cost of the binding agent. It was calculated that the cost of drying a kg of UMB in a dry-air oven at 60° C for 18 hours was found to be about *Nu* 0.25 which was only about 10 per cent of the total cost of the UMB. But the cost of calcium hydroxide, at eight per cent inclusion, was about 32 *Nu*/kg; an exceptionally high cost. In this way a low cost and sufficiently hard UMB was prepared at the cost of *Nu* 2.48/ kg for the ingredients alone, and the selling price of 1 kg of UMB was estimated at *Nu* 4.64, after adding the production cost and profit margin. However, the final price was set at *Nu* 5/kg by the Department of Animal Husbandry.

These initial findings and observations helped to further develop the urea molasses' mixture into a multi-nutrient feed supplement for all kinds of grazing animals. This feed supplement package was found to be extremely useful not only in the southern hills but also in the high mountain areas of the country. However, the transportation of urea molasses' blocks from the production unit to the target areas can be a major constraint to the overall impact of this technology on a particular village community. Another foreseeable disadvantage of UMB supplements in this context of Bhutan is the importation from neighbouring countries of almost all raw materials required to prepare UMB. No doubt, this has left a big question mark on the applicability of UMB supplementation technology in Bhutan. Nevertheless, the prospects of UMB technology are positive as long as the technology is cost effective and helps to improve the net income of small farmers without disturbing the social, political, and traditional heritage of the country. The primary target of UMB technology in Bhutan is the manufacture of low cost and sufficiently hard UMB, so that each farmer living at high altitudes, as well as in the hills, can afford to buy the blocks and supply essential nutrients to their farm animals. One big advantage of the UMB supplement technology is that it provides an integrated approach to optimising the use of available resources within the existing animal production strategy, based on indigenous livestock and small holders.

Chemical Analysis of UMB

Chemical analysis for two types of UMB (with and without inclusion of *Til* cake) were carried out at the Feed Analytical Laboratory, Animal Husbandry Complex, Serbithang, following the traditional procedure of proximate analysis of feed. The results are given in Table 2.

Table 2: Chemical Analysis of UMB

Types of UMB	DM %	On DM basis			* TDN %
		CP %	Ash %	Ca %	
1) With *Til* cake	88	34	21.8	5.5	53
2) Without *Til* cake	87	31	21.5	5.4	49

* Calculated value