FEEDING OF BYPASS PROTEIN TO CROSS BRED COWS IN INDIA ON STRAW BASED RATION

P. J. G. Kunju[1], A. K. Mehta and M. R. Garg

National Dairy Development Board, Anand 388 001, India

Summary

Feeding of bypass protein to lactating animals have been suggested by many research scientists as a way to increase the nutrient supply at the intestinal level thereby enhance animal production in ruminant animals. A feeding trial with a formulated bypass protein feed on straw based ration was carried out by using lactating cross bred cows at the stage of 4th month of their lactation. Bypass protein feed was fed at 5 different levels. Urea Molasses Block was used as a nitrogen source to the rumen microflora. In order to reduce the heat increment straw intake was restricted to all the animals. Urea Molasses Block intake was noticed varying in proportion with the bypass protein feed intake. Milk production was observed increasing in accordance with the level of bypass protein feed intake. However, the maximum response was noticed in cows that were fed 3 kg bypass protein feed. The nutrient availability at this stage was below the NRC (1988) requirements. Other remarkable finding was that the cows maintained the persistency of milk production even after 3rd month of lactation when the ambient temperature was 40℃.

(**Key Words:** Bypass Protein Feed, UMB, Lactation, Straw Based Ration)

Introduction

Appropriate feeding is the cardinal feature in dairy cattle management as the feed costs account for over half of the total milk production cost (Jimmy et al., 1980). The quantity of feed that is utilized for milk production should be optimum to increase the profitability of dairy farmer. This is perceived to be difficult as the dairy cow is often a poor converter. The utilization of dietary protein in the ruminant animal is lower than a simple hydrolytic digestion process because the digestion in ruminant animals depends essentially upon a fermentative process in rumen before the enzymatic digestion (Satter and Roffler, 1975). The condition becomes more complex when the availability of feeds is scarce. In India some 250 million dairy animals out of which 60 million in milk were to be fed to meet the great demand of over 820 million people for milk. In such situation the feeding strategy must aim at optimising rumen fermentation to obtain maximum nutrients from the forage based feeds and supplementation with nutrients at the intestine by bypassing the rumen fermentation to ensure the most favourable balance and efficiency on the use of the nutrients absorbed (Preston and Leng, 1987). The response on milk production in lactating cows in India varied significantly for the same amount of protein fed from different sources (Kunju, 1987). Folman et al. (1981) suggested that the poor conversion rate of protein in ruminant animals are perhaps, owing to rumen protein degradability thus affecting the quantity of amino acids reaching the intestine. The importance of feeding bypass protein for dairy cattle has been discussed by many research scientists (Annison, 1972; Amstrong and Hutton, 1972; Goering and Waldo, 1974; Chalupa, 1974; Gutcho, 1973; Hatfield, 1973; Ørskov, 1972; Preston and Leng, 1987; Leng and Kunju, 1988).

The feeds, available for milk production in India are largely the agro-industrial byproducts usually crop residues such as straws from wheat, sorghum, millet, barley and maize production. These represent some 95% of the forages given to milch animals throughout India. These forages are low in nitrogen and true protein which limits the extent of microbial fermentation in the rumen. The protein meals are the supplements available. These are fed alone or in the form of compound feeds. Some 2 million metric tonnes of such feeds are manufactured in India annually. In order to

[1]Address reprint requests to Dr. P. J. G. Kunju, Vijay Feeds and Farm Touns (P) Ltd, Kodakara, 680 684, Kerala, India.

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increase the feed conversion efficiency for milk production the bypass protein concept was recommended. Before commencing the commercial production of bypass protein supplement a feeding trial using cross bred cattle, fed with bypass protein on straw based ration was carried out.

Materials and Methods

The bypass protein supplement was formulated in a computer using the Liniar Program package in order to maintain the nutrients composition optimum at the least cost. The above feed was then manufactured in the pellet form of 8 mm size in a commercial feed mill. The formula, ingrediants and their chemical compositions are given in table 1. The feed was analysed for RDP (rumen degradable protein) and UDP (undegradable dietary protein) values by using nylon bags technique (McDonald and ϕrskov, 1979).

The protein degradability at different rumen out flow rate for the bypass protein feed is shown in figure 1. Chemical analysis of feeds were done as noted in A.O.A.C (1980). Milk fat was analysed by using infra red milk analyser (Ricco Electronics, Rajasthan, India). The data were analysed using Analysis of Variance.

25 matured lactating Kankraj × Fresien cows about 400 kg body weight of 2nd and 3rd lactation which had calved after 3 to 4 months earlier were selected. The cows were housed in the experimental animal shed with individual

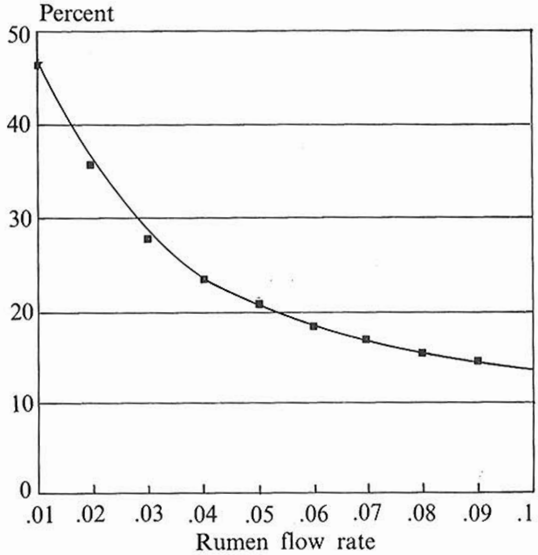

Figure 1. Protein degradability at different rumen flow rate for BPF (—■— Series A).

TABLE 1. INGREDIANTS AND CHEMICAL COMPOSITION OF BYPASS PROTEIN FEED

SrNo	Ingredients	Percent	CP (%)	RDP (%)	UDP (%)
1	Sorghum	10	10	4	6
2	Rice polishings	18	13	2	11
3	Molasses	8	2	–	–
4	Cottonseed meal	40	40	9	31
5	Rapeseed meal	6	40	14	26
6	Peanut meal	15	48	25	23
7	Mineralmixture	2	–	–	–
8	Salt	1	–	–	–
Chemical composition (%)					
1	Dry matter		90		
2	Organic matter		78		
3	Crude protein		30		
4	UDP		20		
5	RDP		10		
6	Crude fiber		6.1		
7	Ether extract		3.5		
8	Insoluble ash		1.3		

RDP; Rumen degradable protein.
UDP; Undegradable dietary protein

TABLE 2. MEAN WEEKLY UREA MOLASSES BLOCK INTAKE PER DAY BY CROSS BRED COWS FED BYPASS PROTEIN FEED ON STRAW BASED RATION

Weeks	Group 1 (kg)	Group 2 (kg)	Group 3 (kg)	Group 4 (kg)	Group 5 (kg)
1	0.43	0.26	0.26	0.17	0.34
2	0.54	0.34	0.17	0.34	0.17
3	0.21	0.26	0.17	0.51	0.34
4	0.54	0.34	0.43	0.43	0.43
5	0.75	0.69	0.69	0.86	0.17
6	0.48	0.39	0.36	0.46	0.31
Mean	0.49	0.38	0.35	0.46	0.29
SEM	± 0.06	± 0.06	± 0.07	± 0.09	± 0.04

mangers. The animals were tested for internal and external parasites. The cows were free of calves as they were taken away at birth. Animals were randomly distributed into 5 groups in which their body weight, milk yield (Fat Corrected Milk) were uniform for each group. All 25 cows were given 7 kg rice straw and urea molasses block (Kunju, 1986) *ad lib.* for 10 days. Fresh drinking water was offered twice a day. Daily milk and fat yields were recorded. After 10 days, of the beginning of the trial body weights were recorded. Based on the above data the animals were grouped into 5 groups of equal weight and milk yield (FCM). The feeding trial was then commenced and continued for 6 weeks. Animals were milked twice and the quantities were recorded.

Milk fat was tested once a week. At the end of the experiment body weights were again recorded. All the animals were given fixed quantity of straw (7 kg/day) and bypass protein feed 0 kg, 1 kg, 2 kg, 3 kg and 4 kg for groups 1, 2, 3, 4 and 5 respectively. Urea Molasses Block (UMB) was given *ad lib.*

Results and Discussion

Feed intake

Since animals were given fixed quantity of straw the response on straw intake was not noticed. The variation in Urea Molasses Block intake was noticed in different groups (table 3). A negative correlation ($R = -0.7$) between UMB intake and nitrogen intake from bypass protein feed was also noticed ($p < 0.01$) as shown below

UMB intake = $514 - 0.16 \times$ N intake

This has shown the animals' self regulatory mechanism to control the intake of urea from UMB in agreement with their need. Kunju (1986) reported that the intake of urea from UMB was controlled by sheep in proportion with the ammonia concentration in the rumen fluid.

TABLE 3. MEAN MILK YIELD IN CROSS BRED COWS FED BYPASS PROTEIN ON STRAW BASED RATION WITH UREA MOLASSES BLOCK

Levels of bypass feed (kg)	Milk* (kg)	FCM (4%)* (kg)
0	5.5 ± 0.08	5.5^a ± 0.47
1	7.7 ± 0.09	7.5^b ± 0.26
2	8.0 ± 0.11	7.8^b ± 0.24
3	8.6 ± 0.13	8.5^b ± 0.13
4	8.0 ± 0.17	7.8^b ± 0.29

* $p < 0.05$. figures with different superscripts are statistically significant.

FCM - fat corrected milk

Milk production response

Milk production response on feeding of bypass protein was almost linear (figure 2). Cows fed on 7 kg rice straw and UMB *ad lib.* maintained 5.5 kg milk yield per day. The animals, given additional 1 kg bypass protein feed yielded 1.2 kg more milk than the animals fed no bypass protein feed. However, all those animals lost their body weight on an average by 120 g and 80 g per day respectively. Further addition of bypass protein feed resulted in increase of milk yield and gain in body weight. The maximum response for bypass protein feed was observed in cows fed 3 kg bypass protein feed. However, further response was not obtained in the cows fed 4 kg

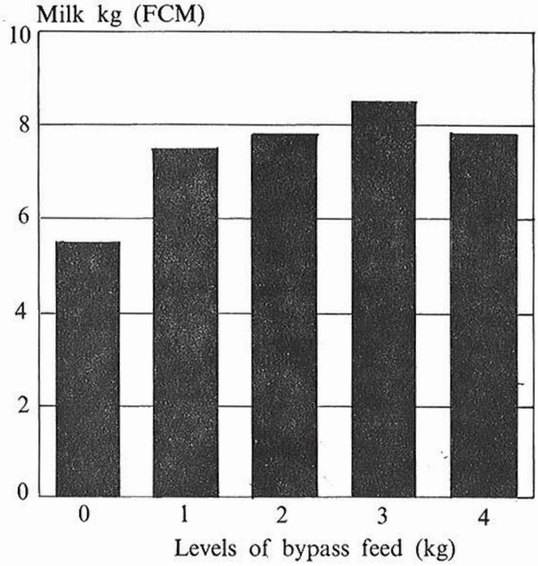

Figure 2. Milk production response to bypass protein feed in cows on straw diet.

feed. It is noticed that all animals were maintaining production at a lower allowance of nutrients calculated as noted in NRC (1988) (table 5).

An increase in Protein/Energy ratio in the absorbed nutrients can improve production through an increase in the efficiency of nutrient utilization (Leng, 1989). Therefore it is assumed that the efficiency of nutrient utilization was increased owing to increase in P/E ratio through feeding both the rumen fermentation and bypass nutrients. As the dry matter intake was restricted the effect seen is presumably due to increase in P/E ratio and to the minimum unproductive oxidation of acetogenic nutrients (Leng, 1989).

Clark and Davis (1980) summarised the effect of crude protein percent in ration dry matter on milk yield during early lactation. They observed that more milk production is noticed at 13 to 14% crude protein level in the ration than 9 to 10%. However increasing crude protein level above 14% resulted in a small but declining rate of increase. Clay and Satter (1979) supported the above findings. Later Clark and Davis (1980) confirmed that the quantity of crude protein consumed daily is more closely correlated (0.57) with milk yield than the percentage of crude protein. The grams of crude protein used for liter milk production published by different

TABLE 4. MEAN LIVE WEIGHT CHANGES IN CROSS BRED COWS FED BYPASS PROTEIN ON STRAW BASED RATION WITH UREA MOLASSES BLOCK

Levels of bypass feed (kg)	Initial Wt (kg)	Final Wt (kg)	Wt changes (kg)
0 SEM	369 ± 49	364 ± 54	−0.12 ± 0.32
1 SEM	379 ± 37	376 ± 48	−0.08 ± 0.47
2 SEM	366 ± 90	374 ± 93	0.20 ± 0.20
3 SEM	373 ± 90	378 ± 25	0.11 ± 0.48
4 SEM	371 ± 51	375 ± 63	0.09 ± 0.29

TABLE 5. NUTRIENTS AVAILABILITY AND REQUIREMENTS FOR THE ANIMALS AS PER NRC 1988

Milk FCM	LWC	Straw	Conc.	UMB	DMI (kg)		CP (kg)		ME (MJ)	
(kg)	(kg)	(kg)	(kg)	(kg)	requ	avai	requ	avai	requ	avai
5.5	−0.11	7	0	0.58	9.1	7.1	0.7	0.5	71	38
7.5	−0.13	7	1	0.39	10.8	7.7	0.9	0.8	84	47
7.8	0.16	7	2	0.36	11.3	8.5	1.3	1.1	96	58
8.5	0.29	7	3	0.46	11.5	9.4	1.5	1.4	105	71

avai; availability.
requ; requirements.

workers are given in table 6. The utilization of crude protein per liter milk production noticed for the present study were 45, 55, 82, 110 and 158 for group 1, 2, 3, 4 and 5 animals.

Persistency of milk production

The persistency of milk production was maintained in all groups leaving out group 1 animals (figure 3). Usually the milk production

TABLE 6. PROTEIN REQUIREMENTS (G / LITER) FOR MILK PRODUCTION OBSERVED BY DIFFERENT WORKERS

SrNo	Protein (g/liter) milk produced	Authors
1	45 to 56 (DCP)	Reid et al., 1966 Broster, 1972
2	95 to 105 (CP)	Gardner et al., 1973 Grive et al., 1974 Gordon, 1977
3	50 to 55 (CP)	Rofler et al., 1978
4	113 to 261 (CP)	Kunju, 1987

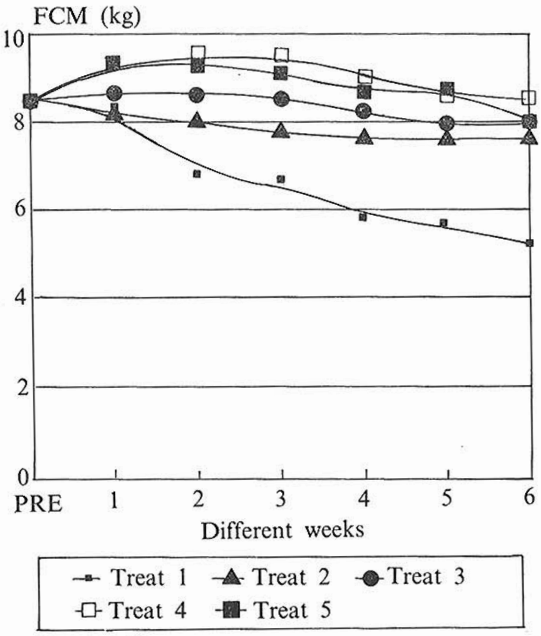

Figure 3. Milk production persistency in cows fed bypass feed.

starts dropping after 3rd month of calving. Moreover, maintaining the persistency during summer months when the temperature is around 40℃ is often impossible. The result therefore, support the argument that the animals were receiving nutrients adequately in the balanced form. According to Blaxter (1962) some 12 to 16 MJ of metabolisable energy was apparently disposed off in cattle in ways other than product formation. In cold stress condition acetate or fat is oxidized. This is less in ruminants under tropical conditions. Therefore in such conditions if animals were fed adequately to balance the nutrients particularly in terms of protein to VFA ratio in rumen and amino acid to glucose in the intestine the animals in the tropics can produce milk on lower digestibility feeds at greater rates than in animals in the temperate countries (Leng, 1989).

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