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SUPPLEMENTATION OF ALKALI TREATED RICE STRAW[1]

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Twenty eight local Bangladeshi calves with average initial liveweight of 84.2 kg were used in an experiment lasting 105 days, to determine the effect of supplementing a basal diet of rice straw with protein and energy. The rice straw was treated with 4% urea (ammonia) and 1% lime and left for ten days. The protein supplements were either 150 g of fishmeal or 300 g/animal/d of sesame oil cake. The fishmeal was included as it is known to escape rumen degradation to a large extent. There were twelve calves on each protein supplement. Within each protein supplement treatment the calves were divided into groups of four, each group receiving 0, 300 or 600 g/animal/d of rice bran.

The observed daily rates of gain (g/d) for the control group and the groups receiving oilcake and increasing quantities of rice bran were 143, 357, 354 and 335 g respectively. For the groups receiving oilcake and increasing quantities of rice bran, they were 188,252 and 235 g respectively.

The effect of supplementing with 150 g of fish meal was found to be highly significant ($P < 0.01$) both in relation to the control group and the groups on sesame oilcake. No apparent effect of the rice bran supplement was recorded. The group receiving oilcake was not found to perform significantly better than the control group, while the groups receiving the additional supplements of 300 and 600 g of rice bran were found to have higher growth rates ($P < 0.05$) compared to the control group.

It is concluded that a small supplement of protein relatively undegraded in the rumen is an essential supplement to urea (ammonia) treated rice straw fed to growing calves.

Key words: rice straw, cattle, supplements, urea, alkali treatment, by-pass protein

The combined results of two earlier trials (Saadullah et al 1981, 1982) strongly suggested that a small supplement of concentrate of no more than 0.5 kg/d to a basal diet of rice straw (untreated or alkali treated), significantly improved both feed utilization efficiency and daily rate of gain.

However, the quantity of concentrate available per head of cattle in Bangladesh has been calculated to be only 88g (Jackson 1980). In this context, it is of interest to determine more precisely whether the response was to the protein or the energy supplied in the concentrate. With reference to Ørskov (1978) it was further decided to test the effect of supplementing a basal diet of urea (ammonia) treated straw with protein of a low rumen degradability.

Twenty-eight male calves which had previously been used in trials reported by Saadullah et al (1981,1982) were used. They were allocated at random to 7 dietary treatments, each with 4 calves. The experimental period was 105 days during which the daily intake and weekly liveweight gains were recorded. Average initial liveweight was 84.3 kg.

Diets: The basal diet was rice straw which had been treated with 4% urea (as a source of ammonia) and 1% lime for a period of 10 days. The treatment method was essentially the same as the one described by Saadullah et al (1981). The straw was offered ad libitum.

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All calves received a fixed supplement of 1 kg of fresh grass (17% dry matter). Bone meal and common salt were given daily in amounts equal to approximately 1% of dry matter intake.

Treatments: One group received the control diet only. In addition, three groups received 150g/animal/d of fish meal and the other three groups received 300g/animal/d of oil cake. Within each of the three groups allocated to each protein source, one group received no further supplements, one group received 300 and one group 600g/animal/d of rice bran.

Protein content: The crude protein content of the diets' dry components were found to be 6.3, 7.0, 8.0, 31.0 and 60.0% of the dry matter for the treated straw, green grass, rice bran, sesame oil cake and fish meal respectively. The fish meal was bought from a modern factory at Chittagong harbour and was of good appearance.No testing of protein degradability was possible.

Statistical analysis: Analysis of variance was used to determine the effect of treatment on growth and feed intake. Duncan's multiple range test was used to test for significance (Kramer 1956).

Results and Discussion

The calves consumed an average 2.97 ± 0.07 kg of straw/d. There were no significant differences in straw intake between groups. Relative to body weight this amounted to about 3% or 94 g/kg $LW^{0.75}$. One calf receiving the control diet had to be taken off the experiment due to excessive weight loss. Initial liveweight, daily liveweight gain , (feed conversion efficiency), total dry matter intake/d and kg dry matter required/kg of gain are given in Table 1.

Table 1:
Number of calves, initial weights, rate of gain, dry matter (DM) intake and kg DM/kg gain.

	Treatments							SE of means
	Control	Fish meal 150 g Rice bran g			Oil cake 300 g			
		0	300	600	0	300	600	
Number of calves	3	4	4	4	4	4	4	
Initial liveweight (kg)	91	85	86	84	80	83	81	4.18
Daily gain (g)	143	357	354	335	188	252	235	0.028
DM intake (kg/day)	3.0	3.2	3.6	3.8	3.3	3.6	3.8	0.069
Kg DM/kg gain	21	9	10	11	18	14	16	

It is apparent from the Table that the best results in terms of both daily growth and feed utilization were achieved by the group receiving 150 g of fish meal and no rice bran. This group gained 357 g/day versus 143 g for the control group. The results were statistically highly significant ($P < 0.01$). The effect on feed efficiency was to decrease the dry matter requirements per kg of gain from 21 to 9 kg. Adding 300 or 600 g of rice bran to the fish meal did not improve the rate of gain, but rather decreased the feed conversion efficiency. Only a slaughter trial of the animals with an accompanying measure of the fat deposition (Mould et al 1982) could have given a complete answer with regard to the effect of the additional supplement of energy from the rice bran.

Unlike the supplement of fish meal, 300 g of sesame oil cake did not improve animal performance. As the fish meal contained 60% of crude protein and the oilcake 31%, the two sources provided the animals with about equal quantities of protein. It is known (Ørskov 1982) that well processed fishmeal has a high fraction of protein which escapes rumen degradation. It seems possible that the protein of the oilcake used in the present experiment was highly degradable in the rumen and thus the response was only obtained with fishmeal where the supplementary protein reached the small intestine.

The groups receiving either 300 or 600 g of rice bran in addition to the oilcake gained at rates (252 and 235 g respectively), which were found to be significantly better than the control group ($P < 0.05$), but if the three groups receiving fish meal were compared to the three groups receiving oilcake, the fish meal groups were still superior ($P < 0.01$).

The better performance of the groups receiving the 300 or 600 g of rice bran as a supplement to 300 g of oilcake might be explained by a fraction of the rice bran protein not being degraded in the rumen, leading to a small, but important increase in total protein reaching the small intestine for absorption. Khan and Davis (1982) recorded an increase in daily gain from 84 to 371 g and an improvement in feed utilization from 47 to 11 kg dry matter per kg of gain due to the addition of 200 g of oilcake to the basal diet of urea (ammonia) treated rice straw, suggesting a much lower rumen degradation of the protein in the oilcake they used.

The clear effect of a small supplement of fish meal to a basal diet of treated straw is in agreement with results reported by Hovell and Ørskov (1981) and Chauhan (1982). In the present experiment 150 g of fish meal gave better animal performances than 900 g of concentrate (300 g of oilcake and 600 g of rice bran). Chauhan (1982) with 13 crossbred heifers in each group over a period of 153 days observed similar performance in terms of both growth rates per day (321 and 336 g) and feed utilization efficiency (11.6 and 10.6 kg dry matter/kg gain), whether the supplement was 1 kg concentrate or 200 g of fish meal to a basal diet of urea (ammonia) treated straw. He used a diet of green sorghum forage ad libitum and 1 kg of concentrate as positive control, but the control group performed no better than the two experimental groups on urea (ammonia) treated straw.

It therefore seems appropriate to conclude that a small supplement of protein which is relatively undegraded in the rumen, to a basal diet of alkali treated straw is more beneficial than a supplement of energy. It is further suggested that such a diet may well be able to replace tropical forages such as green sorghum and napier grass. The results of the present experiment suggest that further research on ways and means of determining and controlling rumen degradability and degree of protection of commonly available protein sources such as oilcake to be a high priority. Fish meal is not commonly available in Bangladesh, but the result reported by Khan and Davis (1982) indicates that oilcake can sometimes sustain almost identical performances.

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