Indian Journal of Animal Sciences **83** (11): 1207–1209, November 2013/Article

Use of spent maize cobs as source of roughage in the ration of Bandur lambs

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Received: 26 March 2013; Accepted: 12 August 2013

ABSTRACT

Bandur lambs (18), 10-month-old, weighing 11.97 kg body weight were randomly divided into 3 groups of 6 each. The lambs were given a basal diet of *ragi* straw and concentrate in control group (T_1). The maize cobs replaced 50 and 100% *ragi* straw in the diet of T_2 and T_3 groups of lambs. All lambs were fed complete diets as TMR with 50:50 of concentrate: roughage meeting the nutrient requirement. Initial body weight, final body weight and the body weight gains were similar among the three groups. There was no effect of the diet on the weight gain. There was no significant change in DMI and nutrient digestibility in different groups. However, incorporation of maize cobs in the diet increased bacterial and fungal counts in the rumen. Bulk density of maize cobs and maize cob-based diets could be increased many folds by converting them in to blocks for easy storage and transportation. The study concludes that ground maize cobs could replace *ragi* straw completely in the ration of lambs.

Key words: Bandur lambs, *Ragi* straw, Spent maize cobs

About 1.9 –3.8 million tonnes of cobs are available for other use. In this investigation, we studied bulk density changes of different form of maize cobs, *ragi* straw and blending with concentrate and their evaluation as animal feed by replacing 50 and 100% *ragi* straw (*Elucine coracana*) in the lamb ration.

Lambs (18) of 10 months of age and 11.97 ± 0.3 kg bw were randomly divided into 3 groups of 6 animals each. All the lambs were fed a diet of roughage: concentrate at 50:50 to provide their nutrient requirements as per the feeding standards (ICAR 1995). Lambs were fed at 9.0 AM in the morning. The lambs were given a concentrate mixture having maize 40, groundnut cake 20, soybean meal 20, rice bran 17, mineral mixture 2 and common salt 1 parts along with *ragi* straw or maize cobs. The concentrate mixture contained 20% CP on DM basis. The T_1 served as control where lambs were fed with *ragi* straw and concentrate mixture in the ratio of 50:50. In T_2 group 50% roughage (*ragi* straw) was replaced with ground maize cobs and in the T_3 group the 100% ragi straw was replaced by ground maize cobs.

The lambs were tied 3 feet apart with separate feed and watering trough system. The animals were offered *ad lib.* clean drinking water. The feed offered was weighed using a digital weighing balance regularly and in the next day the residue was recorded. The maize cobs were manually broken to 1–2 inch (2.5–5.0 cm) pieces and ground finely using an electrically operated grinder. *Ragi* straw was also chopped to 5–6 cm length. A digestion trial of seven days was conducted after 60 days of feeding to determine feed intake and digestibility of nutrients.

Using a steel container of 1 feet^3 volume, the bulk density was measured for as such, semi-ground and finely ground maize cob. The feeds used in this study were made in to blocks by the application of feed block machine supplied by Agricultural Engineering Division, IARI, New Delhi. The bulk density of different forms of maize cobs viz. ground and finely ground were estimated before and after compression. Subsequently all dietary combinations viz., *ragi* straw: concentrate, *ragi* straw: maize cob: concentrate and maize cob: concentrate were subjected to feed block formation using 3000 psi pressure and bulk density changes were recorded.

Before the digestibility trial, rumen liquor was collected at 2 h post-feeding through an oesophageal tube. The samples were analyzed for bacterial, fungal and protozoal population. The Rumen liquor was serially diluted using anaerobic diluents up to 10^{-8}. From 10^{-2} and 10^{-8} dilutions 0.5 ml was inoculated into roll tubes containing 4.0 ml anaerobic media for fungal and bacterial colonies respectively. The tubes were rolled horizontally over ice for peripheral solidification by leaving a central space for colony growth. The tubes were then incubated at 39° C for the growth of microbes. For

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protozoa enumeration 1.0 ml rumen liquor was added to 1 ml formalin solution to avoid bursting of cells on account of change of temperature to room temperature. The rumen ciliates were identified according to Hungate (1966). The protozoa numbers were calculated (Kamra *et al.* 1991).

During digestibility trial feed intake and residues were recorded and total collection of feces was made for all the lambs individually in the fecal collection bags fixed to the rear of lambs. Four suitable aliquot of feces was taken to the lab for analysis. The 5 g total fecal voided were collected daily and 10 ml 20% H_2SO_4 was added to stop microbial activity to avoid nitrogen loss from the sample before crude protein estimation. All the feeds and residues were analyzed for proximate principles (AOAC, 1994) and fiber fractions (Van Soest 1994).The data were analyzed statistically according to Snedecor and Cochran (1994).

Ragi straw contained (%) 4.05 CP, 0.6 EE, 36.18 CF, 7.48 Ash, 84.24 NDF, 53.88 ADF, 92.52 OM and 87.87 total carbohydrates. The maize cobs contained (%) 2.84 CP, 0.48 EE, 34.17 CF, 4.48 Ash, 95.49 NDF, 57.47 ADF, 95.52 OM and 92.2 total carbohydrates. Whereas the concentrate mixture contained (%) 20.37 CP, 1.48 EE, 6.37 CF, 10.56 Ash, 57.06 NDF, and 15.56 ADF, 89.44 OM and 67.59 total carbohydrates on DM basis. Between maize cob and *ragi* straw there was stark difference in CP and NDF content. Maize cob was lower in CP and higher in NDF content which represents hemicelluloses, protein bound to cell wall and cellulose content.

The pH of strained rumen liquor was higher in Control (T_1) and T_2 than T_3 (Table 1). Total VFA concentration in the strained rumen liquor was lower in T_1 and T_2 than T_3. The group T_3 fed with maize cob and concentrate mixture showed higher TVFA which corroborates with the lower pH values in this group. The ammonia-N in SRL in control was higher as compared to T_2 and T_3, which could be due to slightly higher protein content in this group as against T_2 and T_3 or this may be due to the preferentially faster consumption of concentrate mixture when fed with ragi straw. Total Nitrogen was higher in T_3 as compared to T_1 and T_2.

Table 1. Rumen parameters in Bandur lambs in different groups

Parameters	Group 1	Group 2	Group 3	SEM	Significance
pH	6.33	6.33	6.26	0.02	NS
TVFA (meq/dl)	9.07	9.77	10.1	0.30	NS
NH_3-N (mg/dl SRL)	49.93	42.93	46.2	2.02	NS
Total N (mg/dl SRL)	71.60	69.60	71.60	0.66	NS
TCA -N (mg/dl SRL)	25.85	27.25	28.47	0.75	NS
NPN (mg/dl SRL)	35.75	37.61	41.77	1.78	NS

NS, Non-significant.

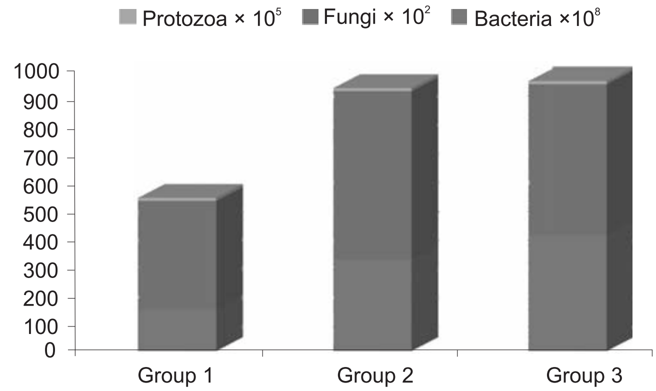

Fig. 1. Bacteria, fungi and protozoa population in rumen liquor of lambs.

As the diets were more or less similar in nitrogen content the higher TCA nitrogen in T_3 than T_1 and T_2 could possibly explain the higher total nitrogen in rumen liquor. Probably maize cobs supported higher microbial growth in the rumen as a result more TCA nitrogen was observed in maize cobs fed groups. As maize cobs contain large amount of hemicellulose which may be enzymatically hydrolysed by rumen microbes yielding xylooligosaccharides (XOS), and in turn these XOS were utilized by microbes leading to an increased microbial population. However, NPN fraction was also higher in T_3 group as compared to T_2 and T_1; this could be possibly due to higher amount of protein bound to cell wall content (NDF) in the maize cobs. Maize cob contains higher amount of total carbohydrates and on replacement of ragi straw in T_2 and T_3 groups the same could have been metabolized by the rumen microbes for energy production.

Table 2. Effect of complete diets on feed intake and digestibility of nutrients in Bandur lambs

Particulars	Group 1	Group 2	Group 3	SEM	Significance
Initial BW (kg)	11.89	11.92	11.97	0.19	NS
Final BW (kg)	16.73	16.72	16.28	0.37	NS
BW gain (kg)	4.83	4.79	4.64	0.14	NS
Intake of DM and plane of nutrition					
DM intake (g/day)	550.32	558.04	517.51	6.85	NS
DMI (% BW)	3.29	3.34	3.18	0.05	NS
DMI (g/kg $W^{0.75}$)	66.61	67.55	63.92	0.87	NS
CP intake (g/day)	72.40	71.86	69.13	2.57	NS
Digestibility co-efficient (%)					
Dry matter	63.89	60.87	60.91	0.90	NS
Organic matter	68.42	64.65	64.44	0.90	NS
Crude protein	73.4	73.72	76.67	1.42	NS
Crude fibre	57.11	53.89	52.14	1.24	NS
Ether extract	62.75	63.55	61.09	1.39	NS
NDF	64.08	60.11	57.56	1.07	NS
ADF	50.54	44.6	43.34	1.33	NS
Total carbohydrate	67.85^a	63.15^b	62.38^b	0.96	($P<0.05$)

BW, Body weight.

As the rumen protein and other nitrogenous compounds are degraded into ammonia and peptides, the ammonia is used by the microbes for their protein synthesis. About 5–7 mg NH_3N / 100 ml rumen liquor is required for normal microbial activity (Satter and Slyter, 1974). However subsequent studies revealed that for the maximum utilization of nutrients 15–20 mg NH_3-N /100 ml rumen liquor is required (Perdok and Leng 1989). Thus to ensure optimum microbial growth and nutrient utilization, the ammonia nitrogen in the rumen liquor in all the 3 groups was adequate in this study.

The total bacterial count was higher in T_2 and T_3 than control T_1 (Fig. 1). The T_3 group fed with maize cobs and concentrate (50:50) showed maximum bacterial counts whereas the control (T_1) fed with *ragi* straw and concentrate mixture showed less bacterial counts and the differences were non-significant. This could be due to higher amount of non soluble fiber fraction in maize cobs which could have supported higher microbial growth in the rumen in maize cobs fed lambs. The total fungal count also followed similar trend to that of bacterial count. The T_2 group fed with *ragi* straw, maize cobs and concentrate mixture (25:25:50) showed maximum fungal counts where as control T_1 fed *ragi* straw and concentrate (50:50) being the least. The protozoa population was more or less similar in all the 3 groups.

Initial body weight, final body weight and the body weight gains were similar among the three groups. There was no effect of the diet on the weight gain. The dry matter intake (DMI) was lower in T_3 however, the differences between the groups were non-significant (Table 2). DMI g/kg $W^{0.75}$ and DMI% was as per the requirements of the lambs ICAR (1995). Digestibility of DM, OM, CP, EE, CF, ADF and NDF were similar among the 3 groups. Total carbohydrate digestibility in control was significantly ($P<0.05$) higher than T_2 and T_3 thereby indicating that the carbohydrates of *ragi* straw was not tightly bound as compared to maize cobs and therefore more available as compared to maize cobs.

There was about 3- fold increase in bulk density on making feed block for as such, semi-ground and finely ground maize cobs. Bulk density of feeds used in this study, maize cob: concentrate (50:50 T_1) and *ragi* straw: maize cob: concentrate (25:25:50 T_2) and *ragi* straw: concentrate (50:50 T_3) were 72.05, 60.16 and 42.38kg/m^3 respectively. Bulk density of diets after making blocks was increased 5.76, 6.50, and 9.03 folds in treatment T_1, T_2 and T_3 respectively. The maize cob: concentrate (50:50) diet showed highest increase 9.03-fold against 3.0-fold that of as such maize cobs.The block making is useful in reducing the volume of bulky feeds and this could be beneficially employed for better storage and transportation.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the financial support provided by National Agricultural Innovation Project of the ICAR for carrying out this study.

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