Effect of Feeding Different Ratios of Green Fodder and Straw Supplemented with Wheat Bran on the Performance of Male Crossbred Calves

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ABSTRACT : Twenty male crossbred calves of about one year of age (average body weight, 196 kg) were distributed in four equal groups following complete randomized design. Wheat bran was supplemented to four different combinations of wheat straw and green fodder (*Sorghum vulgare*) at 40:60, 30:70, 20:80 and 10:90 ratios (on as fed basis) for the feeding of animals in Group 1, 2, 3 and 4, respectively. The feeding trial was continued for a period of 70 days including one metabolism trial of 6 days collection of feed, faeces and urine sample to determine the intake and utilization of nutrients. The intakes (g/kg $W^{0.75}$) of DM, TDN and CP were 93.0±1.8, 55.5±1.1 and 9.51±0.18 in Group 1; 98.0±1.8, 59.6±1.1 and 10.33±0.19 in Group 2; 98.1±2.4, 60.5±1.5 and 10.79±0.26 in Group 3; and 97.7±1.7, 59.1±1.0 and 10.78±0.19 in Group 4, respectively. The digestibility of nutrients did not differ significantly among the groups. Relatively higher nutrient intake and balances of nitrogen reflected non-significantly higher live weight gain in the later three groups (436, 439 and 464 g, respectively) as compared to Group 1 (400 g). The DM intake remained unchanged by increasing the proportion of green fodder beyond 20:80 ratio and thus was assessed to be satisfactory for optimum productivity in animals. (*Asian-Aus. J. Anim. Sci. 2000. Vol. 13, No. 1 : 19-22*)

Key Words : Calves, Growth, Nutrition, Green Fodder, Straw, Wheat Bran

INTRODUCTION

Despite low palatability, digestibility and nutritive value of fibrous crop residues like cereal straws and stovers, it constitutes the staple roughages in the ration of farm animals. The undegradable ligno-cellulosic complexes reduce the availability of fermentable substrates in the ration of farm animals (Orskov, 1998). In tropical countries like India availability of green fodder is very much seasonal. However, green fodder which is also in deficit supply has got definite role in livestock production. It has beneficial effects in terms of voluntary feed intake and nutrient availability. However, to achieve optimum production by using limited green fodder, there is no precise information about the ratio of green fodder and straws/stover to be used for optimum nutrient supply. Therefore, in the present study four different ratios of straw and green fodder supplemented with wheat bran were evaluated with male crossbred calves.

MATERIALS AND METHODS

Animals and feeding

Twenty male crossbred (*Bos indicus*×*Bos taurus*) calves of about one year of age were randomly assigned in 4 groups of 5 animals each (average body weight, 196 kg). Four different combinations of wheat straw and green fodder (*Sorghum vulgare*) at 40:60, 30:70, 20:80 and 10:90 ratios (on as fed basis) were fed *ad libitum* to group 1, 2, 3 and 4, respectively. The green fodder was chaffed (1-4 cm) and mixed with wheat straw (also chaffed, <2 cm) while feeding the animals. In all the four groups, wheat bran was fed about 1.5% of body weight to animals between 100-200 kg and then maximum 3.0 kg to animals above 200 kg of body weight to supply half of the dry matter intake. The feeding trial was continued for a period of 70 days.

Metabolism trial and sample collection

One metabolism trial of 6 days collection of feed, faeces and urine sample was conducted. During the feeding trial, DM offered, residue, and faeces and urine voided during 24 h were recorded. Representative samples of faeces collected were dried in oven and pooled over the period of 6 days. For the analysis of N, aliquots of faeces and urine were preserved in sulphuric acid and pooled over the same period.

Chemical analysis

Samples of feed offered, residue, and faeces voided were analyzed for proximate principles (AOAC, 1980) and cell wall fractions (Van Soest et al., 1991).

Live weight gain

The animals were weighed before feeding and watering fortnightly and then at the end of feeding trial to record the pattern of change in live weight gain in different groups.

Statistical analysis

The data were subjected to analysis of variance in one way classification for completely randomized design as described in Snedecor and Cochran (1989).

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The test of significance among the treatment differences was also analysed.

RESULTS AND DISCUSSION

Chemical composition, intake and digestibility of nutrients

The chemical composition of wheat bran, wheat straw and green fodder is presented in table 1. The green fodder contained 9.17% CP compared to 3.59% in wheat straw. The intake and digestibility of nutrients showed non-significant difference among the groups (table 2). The proportional DM intake contributed from green fodder in different combinations were 23, 32, 44 and 64% in group 1, 2, 3 and 4, respectively. Increasing the proportion of green fodder to 20:80 ratio in the total ration provided an impetus to show relatively better digestibility of nutrients and further increase in the proportion of green had no beneficial effect. This may be attributed to associative effect feed where supplemental green fodder in straw based ration adds to its palatability and thus increased voluntary feed intake in animals. Further, the level of green fodder beyond 20:80 ratio would have depressed the digestibility of cell wall constituents due to probably a preferential selection by rumen microbes for more digestible fibre in green fodder compared to lignified cellulosic material in wheat straw. Silva and Orskov (1988) observed increased rate and extent of degradation of barley straw DM by 9 and 15%, respectively when unmolassed sugar beet pulp or dried grass was given at a level of 150 g/kg straw DM to sheep. In the present experiment numerically higher nutrient density was observed in group 3 where straw and green fodder was nearly in equal proportion in terms of DM.

Table 1. Chemical composition of feed (% DM) and nutrient density of experimental diets

	Wheat bran	Wheat straw	Green fodder
Chemical composition (%):			
DM	89.8±0.2	89.1±0.6	17.5±0.8
OM	95.2	91.5	85.0
EE	4.1	1.3	4.4
CP	15.0	3.6	9.2
ADF	11.9	51.9	38.8
NDF	37.4	84.6	70.0
T-CHO	76.1	86.6	71.4

Nutrient density (%):	Groups*			
	1	2	3	4
CP	10.2	10.5	11.0	11.0
TDN	59.7	60.8	61.7	60.5

* Four different ratios of wheat straw and green fodder at 40:60, 30:70, 20:80 and 10:90 (on as fed basis) were fed to gruop 1, 2, 3 and 4, respectively.

Plane of nutrition and live weight gain

The plane of nutrition and growth performance of animals during the feeding trial is given in table 3. Animals fed with increasing proportion of green fodder in the total ration showed increasing trend of body weight gain. About 10% increase in DM intake from roughages in Groups 2, 3 and 4 as compared to Group 1 accounted for non-significantly higher ($p>0.05$) total DM intake in the former groups, because the

Table 2. Intake and digestibility of nutrients in different experimental groups during metabolism trial

	DM	OM	CP	EE	ADF	NDF	Total carbohydrate
Nutrient intake (kg/d)							
Group 1	4.72	4.38	0.483	0.154	1.34	2.71	3.74
Group 2	4.83	4.48	0.505	0.172	1.39	2.79	3.80
Group 3	4.64	4.29	0.510	0.176	1.27	2.61	3.60
Group 4	5.32	4.83	0.584	0.214	1.49	3.04	4.04
SEM	0.36	0.32	0.029	0.013	0.15	0.26	0.28
Nutrient digestibility (%)							
Group 1	57.8	61.3	53.6	70.3	48.9	51.3	61.9
Group 2	58.6	61.9	54.1	72.8	48.8	50.9	62.5
Group 3	59.8	62.8	55.4	75.3	48.3	50.6	63.4
Group 4	59.7	62.4	56.0	72.7	46.1	51.4	62.8
SEM	1.74	1.65	0.81	1.24	1.60	1.55	1.87

Ratio of wheat straw and green fodder were 40:60 (Group 1), 30:70 (Group 2), 20:80 (Group 3) and 10:90 (Group 4).

level of concentrate was kept constant in all the four groups. Intake of TDN and CP was also higher ($p>0.05$) in the latter three groups in comparison to Group 1. The nutrient intake per unit body weight also followed a similar trend with about 6% higher DM intake in Group 2, 3 and 4. The CP intake in group 1 was little lower due to higher proportion of straw but comparable to recommended values for 400 g gain (NRC, 1989). However, the nutrient intake in all the four groups was as per the standard requirement for crossbred calves of 200 to 250 kg body weight growing at about 400-500 g/day. While feeding animals on sole ration of green fodder Mondal et al. (1995) observed similar level of nutrient intake in Murrah buffalo calves of 210 to 300 kg body weight. Das (1997) observed about 20% higher live weight gain in calves fed with cereal grain replaced concentrate and green fodder based ration than those on similar concentrate and wheat straw based ration. He also observed significantly higher ($p<0.05$) roughage DM intake in green fodder fed groups. In the present experiment the mixture of green fodder and wheat straw increased the palatability of the diet averaging more than 50% DM intake from roughages in all the groups. Further, the ratio of concentrate: roughage was narrowed by 12 to 14% in higher level of green fodder supplemented groups. Highly digestible fibre supplied by green fodder in straw based diet might have stimulated the fibrolytic activity of the rumen (Obara et al., 1991) which in turn influence the voluntary feed intake of roughages. On wheat straw based diet animals failed to meet their nutrient requirement for growth at similar level of concentrate intake due to decrease in voluntary feed intake (Das, 1997). According to Orskov (1998) ruminants consuming straw were likely to have lower rumen contents than the ruminants consuming high quality hay. Because, the feed potential of roughages depends on their ligno-cellulosic complexes which are subjected to ruminal degradation, a combination of straw and green fodder may thus met a better ruminal environment which in turn can influence the voluntary feed intake in animals.

The gain:feed ratio was higher in animals fed on diet with higher proportion of green as compared to group 1, but the difference was non-significant. Due to higher CP content in green fodder there was higher availability of N with the increased level of green fodder in the total ration which reflected in apparently higher N excretion through faeces and urine. The N-balance and live weight gain followed the same pattern being highest ($p<0.05$) in group 4, but the N utilized (N-balance divided by N-absorbed) in all the groups was in the range of 29.01 to 31.63% with non-significant difference among the groups.

The results indicate that the feed intake in all the green fodder supplemented groups increased and thus sustained a growth rate of 400-500 g at the body weight of 225.0 kg and at an age of about 14 months which is optimum for yearling bull or bullock production. Cereal green fodder mixed with wheat straw also showed an associative increase in nutrient utilization. Further a gradual increase in the level of green beyond 80:20 ratio with straw had no additional effect on total DM intake on straw based diet and thus considered to be optimum for animal productivity.

Table 3. Plane of nutrition and growth performance of animals under different dietary combinations

Parameters	Groups*				
	1	2	3	4	SEM
Live weight gain					
Initial BW (kg)	195.8	196.0	196.2	196.4	10.95
Final BW (kg)	223.8	226.5	226.9	228.9	11.87
ADG (g)	400	436	439	464	21.18
Nutrient intake					
DM (kg)					
Concentrate	2.51	2.49	2.50	2.50	0.04
Roughage	2.54	2.91	2.88	2.95	0.19
Total	5.05	5.40	5.38	5.45	0.21
Concentrate: roughage	0.99	0.86	0.88	0.86	0.06
TDN (kg)	3.01	3.28	3.32	3.30	0.12
CP (g)	517	569	592	601	22.8
Intake/100 kg BW					
DM (kg)	2.43	2.57	2.58	2.55	0.05
TDN (kg)	1.45	1.56	1.59	1.54	0.03
CP (g)	251	271	284	281	5.7
Intake/kg $W^{0.75}$					
DM (g)	92.6	98.0	98.1	97.7	1.94
TDN (g)	55.3	59.6	60.5	59.1	1.19
CP (g)	9.51	10.33	10.79	10.78	0.21
Gain (g)/ Feed (kg)	80	81	82	86	3.8
N-balance (g/d)					
N intake	77.23	80.85	81.60	93.39	4.65
Faecal N	35.73	37.10	36.44	41.19	2.28
Urinary N	19.17	19.56	20.72	22.69	1.90
N-balance	22.32^{b}	24.20^{ab}	24.44^{ab}	29.51^{a}	1.38
% N intake	54.19	55.30	54.11	56.54	2.16
% N absorbed	29.01	29.99	29.95	31.63	1.18

* Ratio of wheat straw and green fodder were 40:60 (Group 1), 30:70 (Group 2), 20:80 (Group 3) and 10:90 (Group 4).

[a,b] Means bearing different superscript in a row differ significantly ($p<0.05$).

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