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PERFORMANCE OF GROWING CALVES FED ON BANANA (*MUSA PARADISIACA*) STEM

BHIM SEN[1], JAI SINGH[2], TARUN VERMA[2]* AND PRABHAT R. PATEL[2]
[1]Department of A. H. and Dairying, R. B. S. College, Bichpuri - 283 105, Agra, INDIA
[2]Department of A. H. and Dairying, Institute of Agricultural Sciences, B. H. U., Varanasi - 221 005, INDIA
e-mail: tarunverma.bhu@gmail.com

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***Corresponding author**

ABSTRACT
The present work is planned with an aim to evaluate the chemical composition of the banana stem and its nutritional potential as non-conventional feed resource on cross-bred calves. Performance of 16 growing cross bred (Sahiwal × Jersey) male calves at one and half year of age having average body weight of 353.35 ± 6.50 kg were equally divided into 4 groups. The animals were fed concentrate mixture alongwith wheat bhusa and chaffed dried banana (*Musa paradisiaca*) stem in the ratio of 100:0, 90:10, 80:20 and 60:40 in groups I, II, III and IV, respectively. The feed intake (80.04 g/$w^{0.75}$), digestibility of DM (57.32%), biological value (78.02%), gain in body weight (312.49g/head/day) and nutrients balance were apparently higher in group II than rest of the groups. The per cent digestibility coefficient of OM (57.27), CP (58.47), EE (57.38), CF (56.92), NFE (56.25) and TCHO (56.80) were significantly ($p < 0.05$) higher in group II than the control. The feed cost/100g body weight gain was the lowest in group II (Rs. 2.67). Upto 10% Banana stem can be included in ruminant ration without any anti effect on the body.

INTRODUCTION

Livestock is a back bone of our country, since time immemorial. It is well known that in livestock production about 80 per cent expenditure incurred on feeding alone. Conventional roughage production is continuously decreasing in our country due to shifting of grain producing lands to fruits and vegetables. Shrinking cultivable lands and frequent draught leads to decrease the availability of conventional roughage to fulfill the minimum requirement for ever growing livestock population. Similarly, our country is facing enormous problems regarding demand and supply, in the different forms of feeds, required to the animals. The country faces a net deficit of 61.1% green fodder, 21.9% dry crop residues and 64% feeds (Report, 2011). Some non-conventional feeds are found abundantly in our country, which can be used successfully for feeding of livestock to bridge this gap.

On global basis, Banana leaf and stem may be one of the major substitutes of roughage left after getting the fruits. The banana is the second largest produced food after citrus, contributing about 16% of the world's total fruit production. India is the largest producer of banana, contributing to 27% of the world's banana production (Mohapatra *et al.,* 2010). Banana stem is a rich source of fibre, potassium and vitamin B_6. Banana stem is believed to have a good cooling effect on the body and hence, is recommended in tropical climates (Mohapatra *et al.,* 2010 and Chandrassekaran, 2012). Some of the workers (Sruamsiri, 2007 and Anandan, *et al.,* 2013) predicted that banana stem can be used as roughage for feeding of calves.

Looking after the above facts this investigation was carried out to evaluate the chemical composition of the banana stem and its nutritional potential on the performance of cross-bred calves.

MATERIALS AND METHODS

The entire experiment was conducted at the Department of Animal husbandry and Dairying, I. (Ag). S., Banaras Hindu University, Varanasi, U.P., India. Banana stems were collected from the banana experimental fields of the University. The stalks of banana were spread on the clean ground for sun drying. After 15 days regular turning and drying the stalks were chaffed in smaller size (1/2 inch) with the help of electric driven chaffing machine and further dried and stored. Sixteen-cross bred (Sahiwal × Jersey) male calves having average 353.35 ± 6.50 kg body weight at the one and half year of age were equally divided into 4 groups for metabolic study. The animals were maintained on concentrate mixture with wheat bhusa and chaffed dried banana stem in the ratio of 100:0 (group I), 90:10 (group II), 80:20 (group III) and 60:40 (group IV). The concentrate mixture was fed as per N. R. C. (2001) recommendation. Animals were provided sufficient fresh and clean drinking water twice a day. The metabolic trial was conducted for 45 days of preliminary feeding followed by collection period of 10 days. The feed were offered separately to each animal in morning and evening at equal interval. The feed residue left and faecal matters were collected everyday in the morning at 8 am. A representative sample of feed, residue and faecal matters were collected for proximate analysis (A.O.A.C., 2000). The Biological value of feed protein was

calculated as per procedure described by Agricultural Research Council Bulletin (1965).The data were statistically analysed following the procedure suggested by Panse and Sukhatme (1978).

RESULTS AND DISCUSSION

Chemical composition of feeds

Chemical composition of organic constituents found in banana stem was at par with the components present in wheat bhusa (Table 1). Banana stem contained higher ash (14.85%) and calcium (0.84%) as compared to wheat bhusa (ash 12.75% and Ca 0.84%). The chemical composition of banana leaf found in the present study was at par with the results obtained by Ohlde *et al*. (1979) and Uchida *et al*. (1996). Crude protein, ether extract, calcium and phosphorous contents in the banana leaf were higher than most of the grasses present in the natural grassland (Singh, 1980).

Intake and utilization of organic constituents

The DM intake/100kg body weight was at par in all the feeding groups (Table 3). The feed intake per unit body weight (g/$w^{0.75}$) was the highest in group II (80.04 ± 7.36) followed by groups IV (79.50 ± 9.36), III (78.26 ± 9.23) and I (77.66 ± 8.92). The differences between the groups were not significant. The range of DM intake found in the present study was at par with the range reported by Parthasarathy and Pradhan (1986) and Singh (1998). The digestibility of OM (57.27%), CP (58.47%) and TCHO (56.80%) were very high ($p < 0.01$) in group II as the values found in rest of the groups (Table 2). The digestibility of EE (57.38%), CF (56.92%) and NFE (56.25%) were also high ($p < 0.05$) in group II. The differences in digestibility coefficient of these nutrients did not show any significant variation between the groups I, III and IV. This may be due to the fact that the inclusion of 10 % banana stem may influence the palatability of feed. But, with the increase in the levels of stem in the diet, the feed intake and their nutrients digestibility may reduce due to antinutritional factors present in banana stem. The values found in the present investigation were less as reported by Singh and Pandit (1985 and 1979), but higher than the values reported by Singh (1998) from this station. The variation in feed intake may be due to palatability of different feed ingredients and their amounts used in the ration. The CP and EE digestibility found in the present case were slightly higher than the values reported by Prakash and Singh (2008) when digestibility of nutrients was estimated by using different methods.

Intake and utilization of DCP and TDN

The DCP intake g/$w^{0.75}$ was the maximum ($p < 0.05$) in group II (5.37g) as compared to groups I (4.50g) and III (4.90g). The TDN intake g/$w^{0.75}$ was 35.95, 40.07, 38.03 and 35.09 in groups I, II, III and IV, respectively (Table 3). The differences in the values were not significant. The higher DCP and TDN intake in group II may be due to higher feed intake by this group of animals. The DCP and TDN intake in the present

Table 1: Per cent chemical composition of feeds on DM basis

Feed Stuffs	OM	CP	EE	CF	NFE	Total ash	Ca	P
Concentrate mixture	84.88	19.82	2.40	13.26	49.40	15.12	0.50	0.04
Wheat bhusa	87.25	3.03	1.05	35.73	47.45	12.75	0.22	0.17
Banana leaf*	85.15	3.52	1.25	30.50	49.88	14.85	0.84	0.15

* Banana stem contained 18.34% DM on fresh weight basis. Here OM (organic matter), CP (crude protein), EE (ether extract), CF (crude fibre), NFE (nitrogen free extract), Ca (calcium), P (phosphorous)

Table 2: Per cent digestibility of organic constituents in animals fed on banana stem

Groups	DM	OM	CP	EE	CF	NFE	TCHO
I	56.58 ± 0.45	56.37 ± 0.71	57.31 ± 0.32	56.63 ± 0.39	55.59 ± 0.40	55.69 ± 0.48	55.71 ± 0.38
II	57.32 ± 0.24	57.27 ± 0.20	58.47 ± 0.50	57.38 ± 0.31	56.92 ± 0.16	56.25 ± 0.23	56.80 ± 0.27
III	56.95 ± 0.32	55.27 ± 0.54	57.38 ± 0.29	56.68 ± 0.40	55.97 ± 0.35	55.96 ± 0.44	55.89 ± 0.25
IV	56.48 ± 0.45	56.02 ± 0.35	57.12 ± 0.31	56.40 ± 0.32	55.55 ± 0.37	55.51 ± 0.41	55.58 ± 0.20
CD 5%,1%	-	0.59, 0.85	0.56, 0.81	0.58-	1.00-	0.49-	0.48, 0.69

Here, value ± SEm and DM (dry matter), TCHO (total carbohydrate)

Table 3: Nutritive value of feed in terms of DCP and TDN

Groups	DCP in feed (%)	TDN in feed (%)	DM intake g/$w^{0.75}$	DM intake/ 100kg body weight (kg)	DCP intake g/$w^{0.75}$	TDN intake g/$w^{0.75}$	Biological value (%)
I	5.82 ± 0.70	48.80 ± 6.27	77.66 ± 8.92	2.50 ± 0.05	4.50 ± 0.32	35.95 ± 8.22	77.38 ± 0.55
II	6.06 ± 1.08	50.02 ± 0.083	80.04 ± 7.36	2.50 ± 0.09	5.37 ± 0.26**	40.07 ± 3.71	78.02 ± 1.07
III	6.26 ± 0.62	49.43 ± 0.21	78.26 ± 9.23	2.49 ± 0.03	4.90 ± 0.09	38.03 ± 5.73	77.57 ± 1.77
IV	6.27 ± 0.59	47.37 ± 2.98	79.50 ± 9.36	2.48 ± 0.03	4.99 ± 0.26*	35.39 ± 5.22	77.28 ± 1.27

** significant ($P < 0.01$), * significant ($p < 0.05$) here, value ± SEm and DCP (digestible crude protein), TDN (total digestible nutrients)

Table 4: Average nutrients balances and body weight gain/animal/day(g)

Groups	Nitrogen	Calcium	Phosphorus	Body weight gain	Feed cost/100 g weight gain (Rs.)
I	22.49 ± 7.08	0.48 ± 1.32	0.57 ± 0.68	266.58 ± 30.06	3.06
II	25.59 ± 5.59	1.10 ± 0.28	0.99 ± 0.08	312.49 ± 15.95	2.67
III	23.98 ± 9.25	0.20 ± 1.16	0.86 ± 0.61	254.16 ± 92.67	3.15
IV	24.44 ± 7.67	0.22 ± 1.35	0.59 ± 0.90	254.16 ± 15.95	3.09

Here, value ± SEm

study was at par with the range reported by Singh (1998) and Paul *et al.,* (2013) when growing calves were maintained on forest grass hay and wheat bhusa. The differences in biological values between the groups were not significant.

Balances of N, Ca and P

Nitrogen balances in banana stem fed groups were apparently higher showing indefinite trend in the values than the control (Table 4). Similar to this, higher nitrogen balance was also reported by Singh (1998) when grass hay was fed to growing calves than wheat bhusa fed group. The nitrogen balance found in the present case was within the range as reported by Singh and Pandit (1985).

Calcium (1.10g/head/day) and phosphorus (0.99g/head/day) balances were apparently higher in group II as compared to other groups. These balances were within the range as reported by Singh (1998). Nutrients balances are generally influenced by the feed intake and nutritional/antinutritional factors present in the feeds (Sen, 2001).

Growth performance and cost of feeding

The body weight gain/head/day (Table 4) was the highest in group II (312.49) followed by groups I (266.58) and III and IV (254.16). The body weight gain was apparently reduced when banana stem was incorporated more than 10% in the feed. No any relationship could be drawn between feed intake and body weight gain of the calves. The body weight gain found in the present study was at par with the finding reported by Singh (1998) when calves were fed on different types of roughages. The feed cost/100g body weight gain was the lowest in group II (Rs. 2.67) and highest in group IV (Rs. 3.09). The lower cost incurred in feeding group II may be due to higher gain in body weight on minimum feed intake by the animals.

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