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Effect of feeding dried subabul (*Leucaena leucocephala*) leaf-meal in the complete diets of crossbred calves

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Subabul (*Leucaena leucocephala*) is a promising forage crop for the tropics. The potential value of leucaena as an animal feed is well established. The cost of conventional protein supplements is ever escalating with availability dwindling and there is an impending need to evolve an appropriate alterative for ruminant feeding. Subabul can make a suitable option because of its high nutritive value which is comparable to that of alfalfa forage (National Academy of Sciences 1977). Therefore the present study was undertaken to study and compare the effect of incorporating 50 and 75% of dried subabul leaf-meal in the rations of crossbred calves on nutrient utilization, nitrogen, calcium and phosphorus balances.

Three complete rations containing 0, 50 and 75 % of dried subabul leaf-meal were formulated. CR-1 was a control, containing horse gram hay and other conventional feed ingredients in the ratio of 75:25. In CR-2 and CR-3, 50 and 75 parts of horsegram hay was replaced by dried subabul leaf-meal respectively. The complete rations were made isonitrogenous by adjusting the proportions of groundnut-cake (deoiled) and maize.

The crossbred bull calves (weighing 201.77 ± 6.01 kg) for each experiment were used in a 3 × 3 latin square arrangement to evaluate the rations for nutrient utilization, nitrogen, calcium and phosphorus balances. Each period of latin square consisted of a 14-day preliminary and a 7-day collection period.

Samples of complete rations, feed ingredients, leftovers, faeces were analyzed for proximate analysis as per AOAC (1980) method and cell wall constituents according to Goering and VanSoest (1970). Calcium and phosphorus were determined according to Ferro and Ham (1957) and Fiske and Subba Row (1975) respectively.

Table 1. Ingredient and chemical composition of complete rations containing dried subabul leaves on per cent dry matter basis

	CR-1	CR-2	CR-3
Ingredient composition			
Subabul leaf-meal	0	50	75
Horse gram	75	25	0
Groundnut-cake (deoiled)	18	6	0
Maize	4	16	22
Mineral mixture[a]	1	1	1
Salt	2	2	2
Vitablend[b]		25 g	
Chemical composition			
Dry matter	95.56	95.54	94.96
Organic matter	93.16	91.53	88.33
Non protein organic matter	77.47	75.58	72.79
Crude protein	19.98	20.05	20.09
Ether extract	4.36	3.75	3.25
Crude fibre	27.26	14.09	9.58
Nitrogen free extract	42.02	53.65	55.42
Total ash	6.83	8.46	11.66
Acid insoluble ash	0.62	0.73	0.93
Calcium	1.46	1.80	3.20
Phosphorus	0.81	0.69	0.38

[a] Aries brand of mineral mixture

[b] Vitablend (AD_3) each gram contained vitamin A 50,000 IU and vitamin D_3 5000 IU.

The data were subjected to analysis of variance (Snedecor and Cochran 1968). Differences among treatment means were tested for significance by Duncan's new multiple range test (Duncan 1955).

Chemical composition and cell wall constituents of subabul leaf-meal, was 89.79, 24.00, 4.00, 14.50, 46.05, 11.45, 0.42, 2.81, 0.31, 42.15, 16.10, 26.05, 10.80 and 5.84 for DM, CP, EE, CF, NFE, ash, AIA, Ca, P, NDF, ADF, Hemicellulose cellulose and permangnate lignin, respectively, on per cent drymatter basis. Ingredient and chemical composition of complete rations were presented in Table 1.

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Apparent digestibility coefficients, plane of nutrition and balance of nutrients of rations containing different levels of subabul leaf-meal were present in Table 2. The DM digestibilities were not different between CR-2 and CR-3. However, significant increase in digestibility of control ration was attributed to better quality of horsegram. Similar results were obtained by Gupta *et al.* (1989) when subabul hay was fed at 0, 50 and 80 % in the rations of buffalo bulls. OM digestibilities decreased gradually from ration 1 to 3 as subabul level increased. CP digestibilities were comparable among the experimental rations. Similar results were observed in buffalo bulls (Gupta *et al.* 1989) in bulls (Reddy *et al.* 1994) and in crossbred calves (Reddy *et al.* 1993). EE digestibility of rations 2 and 3 were significantly lower ($P < 0.01$) than ration 1 and no significant difference was observed between rations 2 and 3. These results confirmed the reports Sudhakar and Rama Rao (1987) and Gupta *et al.* (1989). The variation in the present study is attributable to the presence of more pseudofats like xanthophills, chlorophills and carotenoids present in subabul leaf-meal which are estimated as crude fat (EE). CF digestibility results were comparable to the results of Gupta *et al.* (1989). NFE digestibilities were not significantly different among treatments. Sudhakar and RamaRao (1987) and Gupta *et al.* (1989) also reported non-significant differences among NFE digestibilities of rations containing subabul.

The differences in the digestibilities of cell wall constituents (Table 2) were in accordance with the cell wall constituent composition of complete rations and comparable to CF digestibility.

The DMI of calves fed experimental rations were 3.40, 3.71 and 2.67 for rations 1 to 3 respectively. DM intake in ration 3 was significantly lower ($P<0.05$) than that of rations 1 and 2. However, there was no significant difference between rations 1 and 2. These results were comparable with the reports of Lawar and Patel (1986) and Muniga *et al.* (1992).

The DCP and TDN contents were 14.06, 61.45, 13.65, 59.64 and 14.78, 62.18 % for rations 1 to 3 respectively. The DCP and TDN intakes of the calves were comparable to the nutrient requirements of growing calves at 200 kg body weight with an expected growth rate of 500 g (Kearl 1982, NRC 1988). The intake of DCP and TDN of the calves in the present study are similar to the observations of Gupta *et al.* (1986b), Chakraborthy and Ghosh (1988), Reddy *et al.* (1993) and Reddy *et al.* (1994).

Nitrogen intake was not significantly different among the rations. Similar results were reported by Sudhakar and Rama Rao (1987), Gupta *et al.* (1989), and Reddy *et al.* (1993). Nitrogen retention expressed as g/day, N retention expressed as per cent of intake or per cent of absorbed i.e apparent BV (%) were comparable among calves fed rations 1 to 3.

Calcium intake was higher in calves fed ration 3. Calcium retention expressed as g/day was not significantly different among calves fed different rations. However, calcium retention when expressed as per cent of intake, was significant different among the treatments. Bhaskar *et al.* (1987) and Reddy *et al.* (1994) reported positive calcium balances in animals fed subabul leaf-meal.

Intake of phosphorus decreased with increased level of subabul in the rations 2 and 3 compared to the control ration. The retention of phosphorus expressed as g/day was significantly lower in calves fed ration 3. Phosphorus retention expressed as per cent of intake was significantly lower in calves fed ration 2 ($P>0.05$). The present observations

Table 2. Digestibility coefficients, plane of nutrition and balance of nutrients of rations containing different levels of subabul leaf-meal

Parameters	CR-1	CR-2	CR-3	SE± Means
Digestibility coefficients				
DM*	62.78^{b}±0.43	59.14±0.51^{c}	60.89^{bc}±0.27	0.40
OM*	63.14^{b}±0.34	59.53^{c}±0.27	57.36^{c}±0.45	0.57
CPa	70.39±0.34	68.01±0.61	73.58±1.02	0.82
EE**	63.45^{b}±0.23	55.51^{c}±0.36	50.47^{c}±0.33	0.46
CF*	48.87^{b}±0.22	45.09^{c}±0.44	40.46^{d}±0.25	0.52
NFE^{a}	63.93±0.39	61.77±0.79	64.88±0.57	0.84
NDF*	53.61^{b}±0.62	44.24^{c}±1.81	36.69^{c}±0.85	1.44
ADF**	39.02^{b}±0.32	33.26^{c}±0.39	27.46^{d}±0.41	0.14
Hemi-cellulose**	71.25^{b}±0.63	72.06^{b}±0.30	60.82^{c}±0.18	0.26
Cellulose**	51.39^{b}±0.30	46.90^{b}±0.46	41.76^{c}±0.21	0.33
Plane of nutrition				
DMI (kg / 100 kg B.Wt)*	3.40^{b}±0.11	3.71^{b}±0.17	2.67^{c}±0.24	
DCP %^{a}	14.06±2.11	13.65±0.86	14.78±1.12	
TDN%^{a}	61.45±2.89	59.64±3.12	62.18±2.62	
Nitrogen balance (g/day)				
Intake^{a}	174.83±19.23	210.95±18.97	151.67±32.11	7.57
Retained^{a}	105.83±11.22	123.39±10.61	95.98±20.12	5.83
Retained as % of intake^{a}	60.57±0.29	58.52±0.53	63.32±0.88	0.71
Apparent BV (%)^{a}	78.54±0.48	71.76±0.80	80.24±0.97	1.16
Calcium balance (g/day)				
Intake^{a}	82.30±8.91	113.18±11.69	140.40±28.93	11.13
Retained^{a}	45.64±5.11	56.60±5.88	62.81±13.16	7.23
Retained as % intake**	55.41^{b}±0.29	50.00^{c}±0.03	44.68^{d}±0.31	0.31
Phosphorus balance (g/day)				
Intake**	44.99^{b}±4.41	44.13^{b}±5.34	14.93^{c}±3.15	1.36
Retained**	27.60^{b}±2.79	24.96^{b}±3.05	9.40^{c}±1.98	0.71
Retained as % intake**	62.72^{b}±0.05	56.54^{c}±0.08	62.96^{b}±0.14	0.06

^{a}values in the rows are not significantly different ($P>0.05$); ^{bcd}values in the rows bearing different superscripts differ significantly; * $P(<0.05)$; ** $P(<0.01)$.

are similar to the results reported by Bhaskar *et al.* (1987) and Reddy *et al.* (1994).

The present study revealed that subabul can replace up to 90 % of CP of rations in crossbred bull calves without affecting the nutrient digestibility, nitrogen, calcium and phosphorus balances.

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