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Effect of dietary levels of bhend (*Thespesia Populnea*) leaves on the utilization of Paddy Straw in Goats

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Abstract
An experiment was conducted to evaluate Bhend leaves **(***Thespesia populnea***)** and paddy straw (*Oryza sativa*) as a goat feed stuff. Twelve male crossbred kids were randomly divided into 3 groups with four goats in each group. Bucks of in T_1 were given Bhend leaves + paddy straw in 15:85 proportions, in treatment T_2 in 30:70 proportion whereas treatment T_3 received in 45:55 proportion. In addition to this 200 g/day concentrates were commonly offered to all three treatments to ascertain the effect on body weight, live weight changes, dry matter intake, digestibility coefficient, nutritive value in respect to digestible crude protein, total digestible nutrients and feed conversion ratio of kids. The daily dry matter intake (g/d) was found significantly higher ($P<0.05$) in T_2 in comparison with T_3. However, it is at par with T_1. Treatment T_1 found to be at par with T_2 and T_3. The average digestibility coefficients of DM in T_2 (56.24 ± 0.13%) was significantly higher ($P<0.05$) than in T_3 (52.94 ± 0.50%) and treatment T_1 (52.16 ± 0.42%).The nutritive value in respect to DCP and TDN varied significantly ($P<0.05$). It was significantly higher ($P<0.05$) in T_2 than in treatment T_3 and followed by treatment T_1. It may be concluded that incorporation of Bhend leaves and paddy straw in 30:70 proportion to growing kids significantly improved the performance of kids in respect to body weight gain, dry matter intake, digestibility coefficient, nutritive value and feed conversion ratio.

Keywords: Bhend leaves, digestibility, goat, paddy straw, weight gain

Introduction
Goat is very important livestock species of India because of its significant contribution to the national economy. It is the only livestock species from which three crops can be harvested viz. milk, meat and fiber (Mohair/Pashmina/Hair).
Straw constitutes the largest portion of the roughages in the animal diet. Straw have the low nutritive value because they are from mature plants as byproduct of grain production. Paddy straw is characterized by its poor nutritive value. It contains about 80 percent of the substances, which are potentially digestible and are therefore the sources of energy but actual digestibility in ruminants is only 45-50 percent. Straw contain 3-6 percent of crude protein; animals maintained purely on paddy straw often loose body weight because a level of approximately 6 percent protein in the roughage is needed for satisfactory performance of the animals.
Supplementation of poor quality roughage, including crop residue with tree leaves has been shown to increase the intake or digestibility or both. Forage particularly tree leaves form more potential economic source of forage for the livestock (Srinivasulu, *et al*., 1998) [12]. In order to ensure green fodder supply to animals, a combination of cultivated fodder and nutritious but palatable tree foliage holds a promise. (Khatta *et al*., 1999) [6].
Thespesia populnea, commonly known as the Bhend tree, is species of flowering plant in the mallow family, Malvaceae. It is small tree or absorbent shrub that has a pan tropical distribution, found on coasts around the world. They are used to make an ayurvedic medicine that is used to stimulate the blood to dispel toxins and maximize the body's natural defenses. Therefore, an experiment was carried out with the objective of to study the effect of dietary levels of Bhend (*Thespesia populnea*) leaves on the utilization of paddy straw in goats.

Materials and Methods
Twelve male crossbred kids of 6 to 12 months age with comparable body weights were divided into three groups of four animals each. One group was served with Bhend leaves (BL) +chaffed paddy straw (PS) in15:85 ratio, second group was served with Bhend leaves (BL) + chaffed paddy straw (PS) in 30:70 ratio and third group was served with Bhend leaves (BL) + chaffed paddy straw (PS) in 45:55 ratio. In addition with 200 g concentrates were offered

commonly to all the treatment groups. After preliminary feeding of 21 days, collection period of seven days in metabolic cages was followed. The kids were weighed at the beginning of the experiment and at weekly intervals throughout the experimental period. The kids in each group were offered respective feeds *ad lib*. The feed offered, residues left were recorded and daily dry mater intake was calculated. The feed was offered in the morning and evening every day to animals as per their growth requirement. Next day, left over of the feed was weighed and discarded before offering the fresh feed. Thus, records of daily feed intake and weekly body weight changes were maintained throughout the experimental period.

During the collection period of seven days, the representative samples of feed offered were collected and processed for dry matter estimation. The dried samples were weighed, ground and preserved for further analysis. During the collection period, the faeces of experimental animals were collected individually. The daily faecal matter voided was recorded.

Chemical analysis of feeds and fodder

The samples of the experimental feed, feed ingredients and faeces were analyzed for the proximate principles *viz*., Dry matter, Crude protein, Crude fibre, Ether extract, Nitrogen free extract, Total ash and Acid insoluble ash (AOAC, 1985) [1]. The Nitrogen, Calcium and Phosphorus content in the urine were analyzed (AOAC, 1985) [1].

Statistical analysis

The experimental data were statistically analyzed by the Randomized Block Design (Snedecor and Cochran, 1994).

Results and Discussion

Table 1: Chemical composition of feeds (% DM basis)

Attributes	Bhend leaves	Paddy straw	concentrates
Organic matter	92.57	85.30	94.81
Dry matter	34.18	89.40	91.59
Crude protein	18.49	5.41	17.44
Ether extract	7.63	1.24	6.14
Crude fibre	16.51	31.38	7.71
Nitrogen free extract	49.94	47.27	63.52
Total ash	7.43	14.70	5.19
Acid insoluble ash	2.62	4.73	3.27
Tannin	0.68	---	---
Calcium	1.73	0.62	0.32
Phosphorus	0.52	0.16	0.48

The chemical composition (% DM basis) of bhend leaves, paddy straw and concentrate offered to goats during experimental period is given in Table 1. Crude protein concentration was higher in concentrate mixture than bhend leaves and paddy straw. It may be attributed to maintain CP level in feed up to 14%.

Table 2: Mean daily feed intake and live weight changes and feed conversion efficiency in goats.

Attributes	T_1	T_2	T_3
Dry matter intake (DMI)			
DM intake (g/d)	$552.42^{ab} \pm 7.80$	$585.72^{a} \pm 11.54$	$525.78^{b} \pm 13.40$
DMI % (BW)	$3.81^{a} \pm 0.10$	$3.94^{a} \pm 0.10$	$3.65^{b} \pm 0.05$
DMI/kg ($W^{0.75}$)	$74.24^{b} \pm 1.16$	$77.33^{a} \pm 1.20$	$71.09^{c} \pm 0.62$
Live weight changes (kg)			
Initial BW	$14.58^{ab} \pm 0.58$	$14.93^{a} \pm 0.65$	$14.43^{ab} \pm 0.50$
Final BW	15.70 ± 0.61	16.83 ± 0.71	16.06 ± 0.53
Gain in BW (kg)	$1.13^{c} \pm 0.03$	$1.90^{a} \pm 0.06$	$1.64^{b} \pm 0.04$
Gain in BW (g/d)	40.34 ± 1.04	67.86 ± 2.19	58.48 ± 1.32
Feed conversion efficiency			
FCE (%)	$7.31^{b} \pm 0.10$	$11.60^{a} \pm 0.23$	$11.14^{a} \pm 0.29$
Feed required for 1 kg BW	13.69 ± 0.19	8.63 ± 0.17	8.98 ± 0.23

[ab]Mean values with different superscripts with in row differ significantly.

The daily dry matter intake (g/d) was found significantly higher in Treatment group T_2(585.72±11.54) than T_3 (525.78±13.40). However, it was at par with treatment T_1 (552.42±7.80). Treatment T_1 found at par with T_2 and T_3. The higher values of daily dry matter intake (g/day) observed in treatment group T_2 may be due to higher palatability for Bhend tree leaves in group T_2 than group T_3 and group T_1.

The average daily dry matter intake per 100 kg body weight was observed as 3.81 ± 0.10, 3.94 ± 0.10 and 3.65 ± 0.05 kg for treatment groups T_1, T_2, and T_3, respectively. It was also found that average daily dry matter intake per kg metabolic body weight ($W^{0.75}$) were 74.24±1.16, 77.34±1.20 and 71.09±0.62 g in treatments T_1, T_2 and T_3, respectively.

The average daily gain in body weight of animals (67.86± 2.19 g/day) in goats of treatment T_2 was significantly higher than that of animals fed with treatment T_1 as (40.34±1.04 g/day) and (58.48±1.32 g/day) in treatment T_3. There was 7.75, 12.72 and 10.91 per cent of weight gain were observed in the treatment T_1, T_2, and T_3, respectively.

The average feed conversion efficiency recorded was 7.83 ± 0.10, 11.60 ± 0.23 and 11.17 ± 0.29 per cent for treatment T_1, T_2 and T_3, respectively. However, the quantity of feed required for 1 kg gain in body weight were 13.69 ± 0.19, 8.63 ± 0.17 and 8.98 ± 0.23 kg/ animal for treatment group T_1, T_2 and T_3, respectively. Treatment T_2 was observed to be at par with treatment T_3. While, it was significant over treatment T_1 with respect to feed conversion efficiency.

Table 3: Mean digestibility coefficient, nutritive value and mineral balance in goats

Attributes	T_1	T_2	T_3
Digestibility coefficient (%)			
DM	52.16^{b}±0.42	56.24^{a} ±0.23	52.94^{b}±0.50
CP	52.13^{b}±0.25	55.59^{a}±0.39	52.94^{b} ±0.28
EE	51.70^{b}±0.17	55.94^{a}±0.35	52.37^{b}±0.17
CF	52.98^{b}±0.29	58.55^{a}±0.21	53.83^{b}±0.21
NFE	50.58^{b}±0.31	54.22^{a}±0.56	50.85^{b}±0.43
Nutritive value (%)			
DCP	7.18^{b} ± 0.03	7.66^{a} ± 0.05	7.30^{b} ± 0.04
TDN	49.91^{b} ± 0.12	53.70^{a} ± 0.42	50.41^{b} ± 0.31
Nutritive ratio	5.95	6.01	5.91
Mineral balance (g/d)			
N	3.91^{a} ± 0.17	4.72^{a} ± 0.16	3.95^{a} ± 0.19
Ca	1.63^{b}± 0.20	2.43^{a}± 0.17	2.13^{a}± 0.22
P	0.91^{a}± 0.10	1.09^{a}± 0.03	0.99^{a}± 0.14

[ab]Mean values with different superscripts with in row differ significantly

The average digestibility coefficients for DM, CP, EE, CF and NFE (%) were higher in T_2 than T_3 and T_1. The digestibility coefficients for ether extract, crude fibre and nitrogen free extract were found to be significantly lower in the treatments T_1 and T_3 as compared to T_2 treatment.

The nutritive values in respect to the DCP and TDN varied significantly ($P<0.05$) and was higher in T_2 (7.60±0.05 and 53.70±0.40) than T_1 (7.18±0.03 and 49.91±0.12) and T_3 (7.30±0.04 and 50.41±0.31).

Both DCP and TDN values found in the present investigation were significantly higher in treatment group T_2 in comparison with the treatment group T_3 and T_1. The treatment T_2 containing Bhend tree leaves with 30 percent proportion, which resulted in maximum DCP and TDN content, than treatment T_3 containing Bhend tree leaves with 45 percent proportion and treatment T_1 containing Bhend tree leaves with 15 percent proportion. Further, it was observed that the DCP and TDN values in treatment T_2 were statistically superior to other treatments. But the DCP and TDN values in treatment T_1 was at par with the treatment T_3.

Higher nutritive ratio were observed in treatment T_2 (6.01) than treatments T_1 (5.95) and T_3 (5.91).

The retention of nitrogen, calcium and phosphorus was higher in T_2 (4.72±0.16, 2.43±0.17 and 1.09±0.03) followed by T_3 (3.95±0.19, 2.13±0.22 and 0.99±0.14) and T_1 (3.91±0.17, 1.63±0.20 and 0.91±0.10) which may be due to the higher palatability of Bhend tree leaves and suitable composition of all the ingredients in T_2 treatment. Statistical analysis showed that non-significant variation in retention of nitrogen in all treatment groups.

The average retention of calcium in treatment T_2 containing Bhend trees leaves at 30 percent level was found to be at par with treatment T_3 containing Bhend tree leaves in 45 percent proportion. The Bhend tree leaves in 15 percent (T_1) proportion found significantly lower than the other treatments. Non-significant variation in the phosphorus retention was observed in treatment T_1, T_2 and T_3.

Table 4: Mean plane of nutrition and cost of feeding in goats.

Attributes	T_1	T_2	T_3
Plane of nutrition			
DCP intake (g/day)	39.69^{b} ± 0.74	44.85^{a} ± 0.94	38.36^{b} ± 1.06
TDN intake (g/day)	275.71^{b} ± 4.00	314.57^{a} ± 7.31	265.14^{b} ± 7.94
DCP intake/kg $W^{0.75}$ (g)	5.33	6.05	5.19
TDN intake/kg $W^{0.75}$ (g)	37.05	41.54	35.84
Cost of feeding (Rs./kg)			
Bhend leaves	0.50	0.50	0.50
Paddy straw	1.00	1.00	1.00
Concentrate	15.60	15.60	15.60
Cost of feed/kg gain	88.05	53.12	60.43

[ab]Mean values with different superscripts with in row differ significantly

DCP consumption of animals per day and per metabolic body weight were observed higher in T_2 (44.85±0.94) than T_1 (39.69±0.74) and T_3 (38.36±1.06). Whereas DCP consumption in g/day was reported to be higher in T_2 (6.05) tan T_1 (5.33) and T_3 (5.19).

The TDN intake of animals in Treatment T_1 was calculated as 275.79 ± 4.00 g/day and 37.05 g/kg metabolic body weight. However, TDN intake in treatment T_2 was found as 314.57± 7.31 g/day and TDN intake per kg metabolic body weight was 41.54 g/day and in case of treatment T3 the TDN intake was 265.14 ± 7.94 g/day and 35.84 g/kg metabolic body weight.

The average requirement of DCP and TDN for animals with 15 kg live weight (growth rate 50 g/day) is 30 g DCP and 350 g TDN (ICAR, 1985). The consumption of DCP and TDN was significantly higher in treatment T_2 than in treatment T_3 and T_1, which may be due to better utilization and palatability of Bhend tree leaves with low tannin content which were mixed into other feed ingredients and supplied enough quality of nutrients for optimum growth.

The average cost of feed required for one kg weight gain was calculated as Rs. 88.05, 53.12 and 60.43 for treatment T_1, T_2 and T_3, respectively. The cost of feed required for 1.0 kg gain in live weight was higher in treatment T_3 and T_1 than in treatment T_2. Hence, feeding animals with treatment T_2 containing Bhend tree leaves and paddy straw in 30:70 proportions was observed as more economical than other two groups.

Conclusion

From above results, it was concluded that the feed containing Bhend tree leaves and Paddy straw in 30:70 proportion was found superior and economical over the other treatments. Thus, the results of the present investigation indicate that the Bhend tree leaves and Paddy straw in 30:70 proportions improved the growth performance of kids in terms of voluntary feed intake, live weight gain and nutritional aspects of feeds.

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