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Feeding economics of sorghum and bamboo leaves silage on crossbred heifers

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Abstract

The study was conducted on Feeding Economics of Sorghum and Bamboo Leaves Silage on Crossbred Heifers. Proximate composition of individual ingredients and ensiled mixtures was analyzed, followed by a 90 day feeding trial under three treatments: T₁ (100% sorghum silage), T₂ (50% sorghum + 50% bamboo leaves silage) and T₃ (100% bamboo leaves silage). Results revealed that bamboo leaves had higher dry matter, crude protein, crude fibre, ether extract and mineral content than sorghum. Among silage treatments, T₂ recorded the highest crude protein (10.81%) while T₃ showed maximum fibre and mineral contents. Economic analysis indicated that feed cost per kg of silage was lowest in T₃ (Rs. 3.57), but T₂ offered the most desirable balance between nutrient composition and feeding cost. The findings highlight bamboo leaves as a promising alternative fodder resource, with sorghum bamboo combinations offering optimal nutritional and economic outcomes.

Keywords: Silage, sorghum, bamboo leaves, crossbred heifers

1. Introduction

Livestock productivity is heavily dependent on the availability of quality fodder throughout the year. Seasonal scarcity of green fodder necessitates the preservation of forages in the form of silage. Sorghum is widely used for silage making due to its high biomass yield, but its relatively low protein content and high moisture limit its nutritive potential. Bamboo leaves, abundant in many agro-climatic regions, have been identified as a rich source of dry matter, protein, fibre, and minerals, thereby offering potential as a silage ingredient.

The present study was undertaken to compare the proximate composition of sorghum and bamboo leaves, evaluate the nutritional profile of silage prepared from their different combinations, and analyze the cost economics of feeding such silages to crossbred heifers

2. Materials and Methods

2.1 Silage preparation

Silages were prepared using three treatments:

- T₁: 100% Sorghum
- T₂: 50% Sorghum + 50% Bamboo leaves
- T₃: 100% Bamboo leaves

Jaggery and salt were added as fermentation enhancers and silages were stored in 1-tonne capacity silage bags for ensiling

2.2 Proximate composition analysis

The proximate composition of raw ingredients (sorghum, bamboo leaves, jaggery) and prepared silages was analyzed for dry matter (DM), crude protein (CP), crude fibre (CF), ether extract (EE) and total ash using standard AOAC (1995) ^[1] methods.

2.3 Feeding trial and economics

A 90-days feeding trial was conducted on crossbred heifers using the Sorghum silage, Sorghum + Bamboo leaves silage and Bamboo leaves silage. Feed intake was recorded daily and cost analysis included fodder, additives, labour, bagging

and transport.

3. Results and Discussion

3.1 Nutritional composition of ingredients

Table 1: Proximate composition of silage ingredients

Ingredients	Sorghum (%)	Bamboo (%)	Jaggery (%)
Dry matter	28.75	59.92	89.31
Crude protein	6.08	9.43	0.29
Crude fibre	27.69	31.77	--
Ether extract	1.70	4.25	0.10
Total ash	8.21	12.82	4.06

Bamboo leaves contained higher DM (59.92%), CP (9.43%), CF (31.77%), EE (4.25%), and ash (12.82%) than sorghum, which had 28.75% DM, 6.08% CP, 27.69% CF, 1.70% EE, and 8.21% ash. These findings corroborate earlier reports by Bhandari *et al.* (2015) ^[22], Bhardwaj *et al.* (2018) ^[3], and Divya Sakhare (2020) ^[5], confirming bamboo's potential as a mineral and protein rich feedstuff.

3.2 Chemical composition of silage mixtures

Table 2: Chemical composition of ensiled mixtures

Particulars	T ₁ (%)	T ₂ (%)	T ₃ (%)
Dry matter	23.00	34.00	38.00
Crude protein	8.26	10.81	9.13
Crude fibre	29.00	38.00	61.00
Ether extract	1.50	1.50	2.00
Total ash	9.70	11.13	14.30

The chemical composition of silages varied significantly among treatments (Table 2). Sorghum silage (T₁) exhibited 23.0% dry matter (DM), 8.26% crude protein (CP), 29.0% crude fibre (CF), 1.50% ether extract (EE) and 9.70% total

ash (TA). In contrast, sorghum + bamboo silage (T₂) recorded higher values for DM (34.0%) and CP (10.81%), with moderate increases in CF (38.0%) and TA (11.13%). Bamboo silage (T₃) showed the highest DM (38.0%), CF (61.0%), EE (2.0%) and TA (14.30%), though CP was comparatively lower (9.13%). The increase in DM with bamboo inclusion agrees with Paul *et al.* (2025) ^[9] and Kurade (2024) ^[6], suggesting enhanced storability and reduced spoilage risk. Crude protein was maximized in T₂, indicating a synergistic effect of sorghum and bamboo leaves, consistent with findings by Bhatulkar (2020) ^[4]. The sharp rise in fibre content in T₃ corroborates reports by Paul *et al.* (2025) ^[9] and Mogale (2021) ^[7], highlighting bamboo's fibrous nature. Ether extract was slightly higher in T₃, aligning with values reported for bamboo-based silages, while total ash content also increased with bamboo inclusion, confirming higher mineral density as noted by Kurade (2024) ^[6]. Overall, the results demonstrate that bamboo incorporation improved dry matter, fibre and mineral content, with T₂ providing the most balanced nutrient profile.

3.3 Economics of feeding

Table 3: Economics of feeding silage to crossbred heifers under different treatments

Sr. No.	Treatments	T ₁		T ₂		T ₃	
	Particulars	Quantity (kg)	Cost (Rs)	Quantity (kg)	Cost (Rs)	Quantity (kg)	Cost (Rs)
1	Green fodder (sorghum fodder) @ Rs 3/ kg	2100	6300	1050	3150	-	-
2	Green fodder (Bamboo leaves) @ 1.0 Rs/ kg	-	-	1050	1050	2100	2100
3	Jaggery @ 40 Rs/ kg	21	840	21	840	21	840
4	Salt @ 5 Rs/ kg	10.5	52.5	10.5	52.5	10.5	52.5
5	Silage Bag 1 tonne capacity @ 550 Rs/bag	2	1100	2	1100	2	1100
6	Labour charges @ 350/day	2	700	2	700	2	700
7	Transportation	-	-	1	500	1	1000
8	Total cost of feeding (Rs)		8992.5		7392.5		5792.5
9	Daily feed cost (Rs)		99.92		82.14		64.36
10	Total cost/Kg silage (Rs)		5.55		4.56		3.57

The economics of feeding indicated notable differences among treatments. The total green fodder requirement was 2100 kg per treatment, with sorghum used exclusively in T₁ (2100 kg) and partially in T₂ (1050 kg), while bamboo contributed 1050 kg in T₂ and 2100 kg in T₃. Daily feed cost was highest in T₁ (Rs. 99.92), followed by T₂ (Rs. 82.14) and T₃ (Rs. 64.36). Over the 90-day trial, total feed costs were Rs. 8992.5, Rs. 7392.5, and Rs. 5792.5 for T₁, T₂, and T₃, respectively, with corresponding costs per kg silage of Rs. 5.55, 4.56, and 3.57. While T₃ proved cheapest, T₂ provided a desirable balance of cost and nutritional advantage, supporting its suitability as an optimal feeding strategy. These findings align with Pande (2019) ^[8] and Verma (2019) ^[10], who also highlighted the importance of balancing cost

efficiency with digestibility and performance in silage-based rations.

4. Conclusion

The study demonstrated that bamboo leaves are nutritionally superior to sorghum in terms of protein, fibre, ether extract, and mineral content. Silage prepared with sorghum and bamboo leaves in equal proportion (T₂) provided the highest crude protein and balanced nutrient profile, while also reducing feeding costs compared to pure sorghum silage. Bamboo-based silages thus represent a cost-effective and nutritionally viable option for improving fodder availability in crossbred heifer rearing.

Conflict of Interest

Not available

Financial Support

Not available

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