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MV Chaudhari
PG Scholar, Animal Husbandry and Dairy Science Section, College of Agriculture, Nagpur, Maharashtra, India

AB Motghare
Associate Professor (CAS), Veterinary Science, College of Agriculture, Nagpur, Maharashtra, India

Bhavana R Wankhade
Assistant Professor, Section of Animal Husbandry and Dairy Science, College of Agriculture, Nagpur, Maharashtra, India

MN Patond
Assistant Professor, Anand Niketan College of Agriculture, Warora, Maharashtra, India

Corresponding Author:
MV Chaudhari
PG Scholar, Animal Husbandry and Dairy Science Section, College of Agriculture, Nagpur, Maharashtra, India

Studies on growth performance of crossbred heifers on feeding of silage prepared from sorghum and bamboo leaves

MV Chaudhari, AB Motghare, Bhavana R Wankhade and MN Patond

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Abstract
This study evaluated growth performance of crossbred heifers on feeding of silage prepared from sorghum and bamboo leaves. Total twenty seven heifers were randomly assigned to three dietary treatments for 90 days: T_1 (100% sorghum silage), T_2 (50% sorghum + 50% bamboo leaves silage) and T_3 (100% bamboo leaves silage). Animal performance parameters including feed intake, dry matter intake and growth performance was recorded. Results indicated that T_2 showed significantly higher feed intake (19.63 kg/day), DMI (7.06 kg/day) and body weight gain (30.21 kg), compared to T_1 and T_3. T_2 also led to superior growth in body length, height and chest girth. These findings support the use of bamboo leaves in combination with sorghum to enhance silage nutritive value and heifer performance.

Keywords: Crossbred heifers, silage, bamboo leaves, growth performance

Introduction
Dairy farming is a vital component of Indian agriculture, especially in rural regions where nearly 70% of the population resides, contributing about 28.4% to the agricultural GDP. As India continues to be the world's largest producer and consumer of dairy products, dairy farming has transitioned from a traditional activity into a professional industry, offering stable income and employment to small and marginal farmers. Green fodder is the most economical and nutrient rich feed for dairy animals, supplying essential carbohydrates, proteins, minerals and vitamins. However, the country faces a significant deficit 35.6% in green fodder, 10.95% in dry fodder and 44% in concentrates (IGFRI Vision, 2050, 2015) and only 4% of cultivated land is devoted to fodder crops. The productivity of natural pastures is also declining due to overgrazing and land-use shifts. Since over two-thirds of animal production costs are attributed to feed, addressing fodder shortages is crucial to improve farm profitability. Silage making is a practical method to preserve and enhance the digestibility of green fodder like sorghum, a drought- and salt tolerant crop ideal for arid regions (Zhang *et al*., 2016) [10]. Bamboo, a rapidly growing grass species with over 1400 varieties, is gaining attention as a non-conventional forage due to its year round availability, rumen friendly fiber profile and methane reducing potential in livestock. The integration of silage techniques using alternative green fodder sources like sorghum and bamboo could be a viable solution to bridge the seasonal fodder gap, enhance livestock productivity, reduce feeding costs and support the sustainability of dairy farming systems in India.

Materials and Methods
The trial was conducted at College of Agriculture, Nagpur, over 90 days using 27 crossbred heifers (20-25 months age). Animals were randomly allotted to three treatments (n=9/group):

- **T_1:** 100% sorghum silage
- **T_2:** 50% sorghum + 50% bamboo leaves silage
- **T_3:** 100% bamboo leaves silage

All animals received *ad lib* dry fodder, green fodder, concentrate and clean water

- Body weights of the experimental animals recorded by Shaeffers formula or a weight tape.

- Body height was measured from ground levels to wither point.
- Body length was measured by measuring length from shoulder point to pin bone.
- Chest girth was measured by measuring circumference of chest wither point.

Results and Discussion

Feed Intake of Crossbred Heifer

Table 1 presents the average daily feed intake of crossbred heifers across different dietary treatments, showing significant variation ($P<0.05$). Heifers in T_1 (100% sorghum silage) had an average daily intake of 18.37 kg (7.54 kg/100 kg BW), while those in T_3 (100% bamboo leaves silage) consumed 18.72 kg (7.35 kg/100 kg BW). T_2 (50% sorghum + 50% bamboo leaves silage) recorded the highest feed intake at 19.63 kg/day (8.49 kg/100 kg BW), despite having the lowest average body weight. This superior intake in T_2 suggests better palatability and nutrient utilization efficiency of the mixed silage. Similar results were reported by Dibragede (2019) [2].

Table 1: Average feed intake of different treatments under different groups

Treatments	Average body weight (kg)	Daily feed intake (kg)	Daily feed intake 100 kg body weight
T_1	243.65	18.37	7.54
T_2	231.10	19.63	8.49
T_3	254.63	18.72	7.35

Dry Matter Intake of Crossbred Heifers

Dry matter intake values shown in Table 2 also varied significantly ($P<0.05$). T_2 had the highest daily DMI at 7.06 kg (3.05 kg/100 kg BW), followed by T_3 at 6.40 kg (2.51 kg/100 kg BW), and T_1 at 5.93 kg (2.43 kg/100 kg BW). The superior intake in T_2 reflects enhanced digestibility and nutrient availability due to balanced fiber and protein content. These findings align with Verma (2020) [8] and Raut (2024) [6], who noted higher DMI values and improved utilization in treatments using mixed or processed fodder.

Table 2: Average DMI of experimental heifers under different treatments

Treatment	Average body weight	DMI/ day / heifer	Daily DMI / 100 kg BW
T_1	243.65	5.93	2.43
T_2	231.10	7.06	3.05
T_3	254.63	6.40	2.51

Weight gain of of Crossbred Heifers

As shown in Table 3, average body weight gain was significantly higher in T_2 (30.21 kg), followed by T_3 (24.37 kg) and T_1 (19.93 kg). Daily gain was also highest in T_2 (0.13 kg/day), suggesting that the nutrient balance in sorghum and bamboo leaf silage supported superior growth. These findings agree with Indoria (2016) [4], Bhatulkar (2020) [1] and Vivekanand (2020) [9], who reported increased weight gains when heifers were fed diverse combinations rich in fermentable fiber and protein.

Table 3: Average weight gain of experimental heifer under various treatments weight

Treatment	Average initial weight (kg)	Average final weight (kg)	Average gain in weight (kg)	Average weight gain per day (kg)
T_1	243.65	263.57	19.93	0.08
T_2	231.10	261.31	30.21	0.13
T_3	254.63	279.00	24.37	0.09

Body Measurements of Crossbred Heifers

Body Height

As per Table 4, heifers in T_2 recorded the highest body height gain of 13.50 cm, followed by T_3 (11.50 cm and T_1 8.80 cm. These results support the observations by Bhatulkar (2020) [1] and Raut (2024) [6].

Body Length

Table 4 shows that T_2 heifers again led with a length gain of 11.00 cm, followed by T_3 9.50 cm and T_1 7.80 cm. These findings mirror the trends reported by Sekhonyana (2015) [7], Patil (2018) [5] and Kiran Raut (2024) [6], who emphasized the role of fiber quality and protein levels in stimulating skeletal growth

Chest Girth

Table 4 reveals that T_2 also showed the highest chest girth gain 15.00 cm, followed by T_3 12.00 cm and T_1 (9.60 cm, The improved chest girth in T_2 likely results from better rumen development and muscular expansion, consistent with findings by Sekhonyana (2015) [7] and Bhatulkar (2020) [1].

Table 4: Body measurements of experimental heifers under various treatments

Parameter	T_1 Gain (cm)	T_2 Gain (cm)	T_3 Gain (cm)
Height	8.80	13.50	11.50
Length	7.80	11.00	9.50
Chest Girth	9.60	15.00	12.00

Conclusion

The present study revealed that incorporating bamboo leaves with sorghum in silage preparation significantly enhances the nutritive value and growth performance of crossbred heifers. Among the three treatments, T_2 (50% sorghum + 50% bamboo leaves) demonstrated the highest feed intake (19.63), dry matter intake (7.06 kg/day), average body weight gain (30.21 kg) and improvements in body measurements including height, length and chest girth. These results suggest that the combination of sorghum and bamboo leaves not only improves feed intake and nutrient

utilization but also supports better skeletal growth and overall performance of the animals. Thus, mixed silage of sorghum and bamboo leaves can be a viable, sustainable and cost effective alternative for addressing green fodder shortages and enhancing livestock productivity in dairy farming systems.

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