



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
© Agronomy
NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; SP-9(8): 459-462
Received: 02-06-2026
Accepted: 08-07-2026

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Comparative evaluation of biometric parameters of Bajra-Napier fodder varieties in Kerala

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DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i8Sf.6376>

Abstract

Green fodder plays a vital role in improving reproductive efficiency and enhancing milk production, that contributes to the economic sustainability of dairy enterprises. The present study was conducted to compare the biometric characteristics of two Bajra-Napier hybrid fodder varieties, *Susthira* and Super Napier, under the agro-climatic conditions of Kollam district, Kerala. On-farm trials were conducted during 2023–24 and 2024–25 at *Velamanoor, Pattazhy, and Kareepra* Panchayats of Kollam district under the Animal Husbandry discipline of ICAR–Krishi Vigyan Kendra, Kollam to assess the performance of green fodder varieties. The fodder growth parameters including plant height, leaf length, leaf width, number of leaves per plant, stem girth, and number of tillers per plant were assessed. Data recorded from ten randomly selected plants were analysed using an independent t-test. Results revealed that Super Napier attained a greater plant height (380.3 ± 14.32 cm) than *Susthira* (323.5 ± 13.61 cm), although the difference was not significant ($p = 0.50$). *Susthira* recorded significantly higher leaf length (138.83 ± 3.76 cm), leaf width (5.46 ± 0.45 cm), stem girth (1.85 ± 0.15 cm), and number of tillers per plant (18.41 ± 0.80) compared to Super Napier (120.75 ± 4.55 cm, 3.85 ± 0.63 cm, 1.56 ± 0.20 cm, and 13.08 ± 1.35 , respectively). The number of leaves per plant was numerically higher in Super Napier but did not differ significantly between varieties ($p = 0.08$). The superior leaf dimensions, stem girth, and tillering ability noted in *Susthira* indicate its higher potential for biomass production and sustained fodder availability. The study revealed that *Susthira* is a promising perennial multi-cut fodder variety that can be recommended for dairy farmers in Kerala to enhance fodder production and to support profitable dairy farming.

Keywords: Green fodder, Bajra-Napier hybrids, *Susthira*, Super Napier, biometric parameters

1. Introduction

India, the world's largest milk producer, accounting for approximately 24 per cent of global milk production, has demonstrated sustained growth in milk output, increasing from 209.96 million tonnes in 2020–21 to 221.06 million tonnes in 2021–22, representing a 5.29 per cent annual increase. Dairy farming plays a crucial role in the rural economy, serving as a primary source of income, employment, and nutritional security for families in Kerala. A key factor influencing milk production is the availability of quality fodder. Sufficient availability of green fodder plays a key role in correcting infertility problems, enhancing milk production, and finally improving economic prosperity of dairy enterprises (Birthal and Jha, 2005; Ghosh *et al.*, 2022) ^[1, 2]. Green fodder, known for its high palatability and digestible nutrients, is essential for improving digestion, rumination, and overall milk yield in crossbred dairy cattle. As per the data from the Dairy Development Department, the total required fodder for the milch animals in the state is 335.5 lakh kg per day and Kerala produces only 60 percent of the roughage required for its cattle, posing a major challenge for small and marginal farmers who have limited land to spare for fodder cultivation (Dairy Development Department Annual Plan 2023-2024) ^[3].

The shortage of quality fodder remains a significant constraint in enhancing milk production. To address this challenge, farmers adopt various fodder cultivation practices to ensure a sustainable and consistent supply of quality forage, thereby supporting the long-term sustainability of the dairy sector. Among these, multi-cut perennial grass fodders, particularly hybrid Napier varieties, are widely preferred due to their higher tiller density, superior leaf production, and greater fodder yield compared to traditional Napier grass. The hybrid is a triploid and hence sterile and does not produce seeds. Pandey and Roy (2011) ^[4] reported that among the improved

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fodder grass species, hybrid Napier is a multi-cut perennial grass with profuse tillering and very good tonnage throughout the year.

It is estimated that feed alone constitutes about 60-65 per cent of the total cost of milk production, which can be reduced to 30-40 per cent by providing inexpensive and quality green fodder like hybrid napier (Thomas, 2008) ^[5] with a productivity of 280 t/ha (Gupta *et al.*, 2019) ^[6]. Napier hybrids are typically produced by interspecific hybridization of Bajra (*Pennisetum glaucum*) and Napier grass (*Pennisetum purpureum*). 'Susthira' - a bajra Napier hybrid (*Pennisetum glaucum* x *Pennisetum purpureum*) recently released under AICRP on forage crops at the College of Agriculture Vellayani, Thiruvananthapuram, Kerala Agricultural University in 2021. Super Napier (SN) Pak Chong-1, a hybrid Napier variety resulting from the cross between *Pennisetum purpureum* (ordinary Napier) x *Pennisetum glaucum* (pearl millet), was developed in Thailand and is rapidly gaining acceptance among dairy farmers of Kollam District. (Kiyothong, 2014) ^[7]. Super Napier grass is reported to contain a crude protein content of approximately 16–18 per cent, indicating its superior nutritional quality (Liangco *et al.*, 2019) ^[8]. Furthermore, Liangco *et al.* (2019) ^[8] also reported that Super Napier requires lower production inputs and is easier to establish than maize, making it a suitable alternative forage crop, particularly in production systems that require a consistent daily supply of nutritious fodder. The present study was undertaken to compare the biometric characteristics of Super Napier and the newly released fodder variety 'Susthira', developed by Kerala Agricultural University, among the dairy farmers of Kollam District.

2. Materials and Methods

The present study was conducted over two consecutive years (2023–24 and 2024–25) at Velamanoor, Pattazhy, and Kareepra Panchayats of Kollam District, Kerala, as part of an on-farm trial under the Animal Husbandry discipline of ICAR–Krishi Vigyan Kendra (KVK), Kollam. The study area is located at 8.89° N latitude and 76.61° E longitude, with an average elevation of 198 m above mean sea level. Kollam district experiences a typical tropical humid climate influenced by four distinct weather conditions. The southwest monsoon (June–September) contributes the major share of annual rainfall, followed by the

northeast monsoon (October–December), which brings intermittent showers. The summer season (March–May) is generally hot and humid, with maximum temperatures ranging from 32 °C to 36 °C, whereas the winter season (December–February) is comparatively cooler, with temperatures ranging from 22 °C to 28 °C. The district receives an average annual rainfall of 2,450–2,700 mm, most of which occurs during the monsoon period. The average maximum temperature ranges between 31 °C and 32 °C, while the average minimum temperature ranges from 23 °C to 25 °C. During the crop growth period, a total rainfall of 256.8 mm was recorded, and the mean daily sunshine duration was approximately 8.3 h per day and planted during Southwest monsoon season. Overall, the prevailing weather conditions during the study period were favourable for the growth and development of Bajra Napier hybrid fodder varieties.

The field was ploughed twice using a tractor to loosen the soil and then levelled to prevent waterlogging. Two-nodded stem cuttings (slips) were used as the planting material. Ridges and furrows were prepared, and the cuttings were planted at a 45° angle with a spacing of 60 cm × 60 cm. During planting, fertilizer application was done with 25 tons of farmyard manure (FYM) per hectare to improve soil fertility, along with fertilizer application at the rate of 200:50:50 kg NPK/ha. The first irrigation was given at the time of planting, the second on the third day, and then on a weekly basis based on rainfall availability. Hand weeding can be done on a need basis during the 30th and 60th days after planting (DAP). The first fodder harvest was done on the 75th day and subsequent harvests at an interval of 45 days. Standard agronomic practices were followed to raise the crop. Observations were recorded from ten randomly selected plants on six quantitative variables viz., plant height (PH), (to the tip of the top leaf), leaf length (LL), leaf width (LW), number of leaves per plant (NOL), stem girth (SG) (calculated from lower stem) and green fodder yield (GFY) (for first 3 cuts) and average value is calculated. The data were analysed using the independent t-test method, following Snedecor and Cochran (1967) ^[9].

3. Results and Discussion

Results regarding the Biometric Parameters recorded for hybrid Napier varieties is given in Table 1.

Table 1: Biometric parameters recorded for Hybrid Napier varieties

Sl. No.	Parameters	Susthira	Super Napier	p-value
1.	Plant Height PH (cm)	323.5 ± 13.61	380.3 ± 14.32	0.50
2.	Leaf Length LL (cm)	138.83 ± 3.76	120.75 ± 4.55	0.01*
3.	Leaf width LW (cm)	5.46 ± 0.45	3.85 ± 0.63	0.00*
4.	Number of Leaves/Plant (NOL)	222.75 ± 15.75	236.25 ± 12.8	0.08
5.	Stem grith (SG) cm	1.85 ± 0.15	1.56 ± 0.20	0.01*
6.	Number of Tillers/plant (NT)	18.41 ± 0.8	13.08 ± 1.35	0.00*

p-value which is less than 0.05 was considered statistically significant and less than 0.01 was considered highly significant

The present study revealed variations in the biometric characteristics of the two Bajra-Napier fodder varieties, *Susthira* and Super Napier (Figure 1). Plant height was numerically greater in Super Napier (380.3 ± 14.32 cm) than in *Susthira* (323.5 ± 13.61 cm), although the difference was not statistically significant ($p = 0.50$). Plant height is an important indicator of vegetative growth and biomass accumulation in forage crops. Previous studies have reported considerable variation in plant height among Bajra-Napier hybrids due to genetic differences and environmental conditions. Taller plants generally contribute

to higher green fodder yield, although height alone may not accurately reflect forage productivity (Reddy *et al.*, 2013) ^[10]. Leaf length and leaf width were significantly higher in *Susthira* than in Super Napier ($p < 0.05$). *Susthira* recorded longer leaves (138.83 ± 3.76 cm) and wider leaves (5.46 ± 0.45 cm), indicating a larger photosynthetic surface area. Similar observations were reported by Vinutha *et al.*, (2018) ^[11], who suggested that Bajra-Napier hybrids with larger leaf dimensions produced greater forage biomass and improved nutritive value.

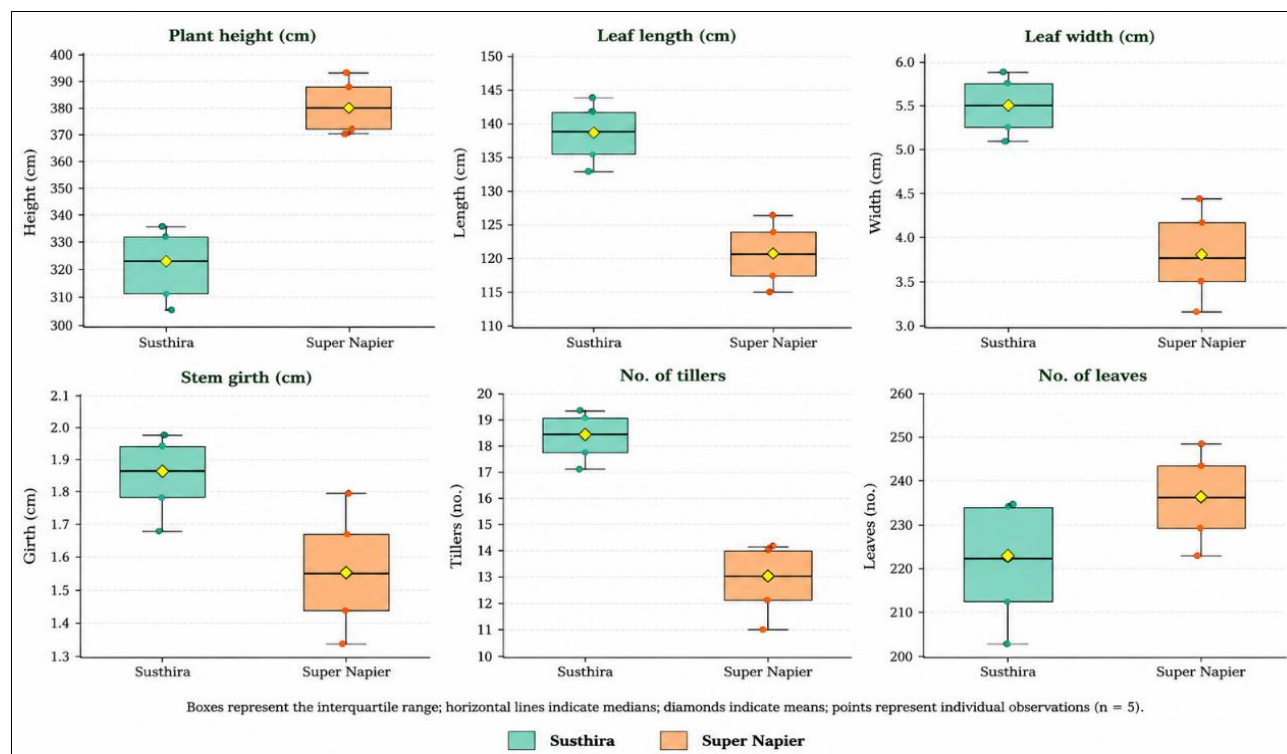


Fig 1: Box-plot comparison of biometric parameters in *Susthira* and Super-Napier

Super Napier produced a slightly higher number of leaves per plant (236.25 ± 12.80) than *Susthira* (222.75 ± 15.75), the difference was not significant ($p > 0.05$). The number of leaves per tiller or plant, contributes to canopy development and forage yield. However, leaf size and total leaf area often exert a greater influence on biomass production than leaf number alone (Halim *et al.*, 2013) [12]. Therefore, the superior leaf length and width observed in *Susthira* may compensate for its slightly lower leaf count.

Stem girth was highly significant ($p < 0.01$) in *Susthira* (1.85 ± 0.15 cm) compared to Super Napier (1.56 ± 0.20 cm). Stem girth is often associated with plant vigour and biomass accumulation. Similar findings have been reported in evaluations of Napier hybrids, where varieties with larger stem diameters exhibited higher green fodder yields (Ansah *et al.*, 2010) [13]. However, excessive stem development may reduce digestibility due to increased fibre content, highlighting the importance of balancing stem and leaf growth.

The most notable difference between the varieties was observed in the number of tillers per plant. *Susthira* produced significantly more tillers (18.41 ± 0.80) than Super Napier (13.08 ± 1.35) ($p < 0.01$). Tillering capacity is one of the most important traits influencing forage yield because each tiller contributes additional leaves and stems for harvest. Enhanced tillering has been consistently associated with increased biomass production and faster regrowth after cutting in perennial forage grasses (Singh *et al.*, 2015) [14]. The superior tillering capacity of *Susthira* indicates a greater potential for sustained fodder production under field conditions.

Kumar and Singh (2004) [15], Mali *et al.* (2015) [16], Kapoor (2017) [17] and Toor *et al.* (2017) [18] reported that the dry forage yield/ plant is significantly and positively correlated with green fodder yield and growth attributes like plant height, number of leaves/ plants, and stem diameter. Overall, results suggest that *Susthira* possesses superior biometric traits related to fodder productivity, particularly in terms of leaf dimensions, stem girth and tillering ability. While Super Napier exhibited greater plant

height and a marginally higher number of leaves per plant, these advantages did not translate into statistically significant differences. The findings indicate that *Susthira* may offer greater potential for green fodder production under the agro-climatic conditions of Kerala.

4. Conclusion

The findings of the present study demonstrate that the Bajra Napier hybrid variety *Susthira* performs better than Super Napier under the field conditions of Kollam district, Kerala. *Susthira* exhibited significantly higher leaf length and tiller production, which contributed to improved fodder characteristics. Hence, *Susthira* can be recommended as a superior perennial multi-cut fodder variety for enhancing milk production and improving the profitability of dairy farming in Kerala.

Acknowledgement

Authors would like to thank the Director, ICAR-Agricultural Technology Application Research Institute (ATARI), Bengaluru, for the technical support for the work.

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