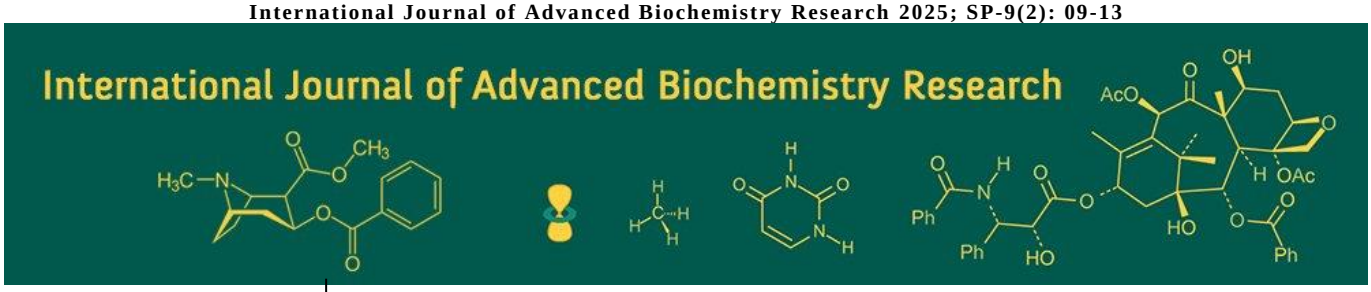

ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2025; SP-9(2): 09-13
www.biochemjournal.com
Received: 12-11-2024
Accepted: 17-12-2024

Chilumula Rama Krishna
Department of Livestock Farm Complex, College of Veterinary Science PVNRTVU, Hyderabad, Telangana, India

Arumbaka Sudheer Babu
Department of Animal Nutrition, College of Veterinary Science PVNRTVU, Hyderabad, Telangana, India

Sagi Raju
Department of Animal Nutrition, College of Veterinary Science PVNRTVU, Mamnoor, Warangal, Telangana, India

B Sampath Kumar
Department of Veterinary Biochemistry, College of Veterinary Science PVNRTVU, Mamnoor, Warangal, Telangana, India

Corresponding Author:
Chilumula Rama Krishna
Department of Livestock Farm Complex, College of Veterinary Science PVNRTVU, Hyderabad, Telangana, India

Comparative evaluation of various hybrid Napier Bajra and multicut sorghum green fodders for proximate composition, fodder quality and digestibility parameters

Chilumula Rama Krishna, Arumbaka Sudheer Babu, Sagi Raju and B Sampath Kumar

DOI: https://doi.org/10.33545/26174693.2025.v9.i2Sa.3683

Abstract
The livestock sector is a cornerstone of India's agricultural economy, yet its productivity is often hindered by the limited availability and poor quality of fodder. This study aimed to evaluate the nutritional composition and digestibility parameters of selected green fodder species, including Bajra Napier hybrid grasses (CO-4, Super Napier, Red Napier, and APBN-1) and multi cut sorghum varieties (CSV 33 MF, CSH 24 MF, and SSG 59-3). Samples were harvested at the pre-blooming stage and analysed for their chemical composition and forage quality parameters using standard protocols. Significant variations (p<0.05) were observed among the fodder varieties for key nutrients such as crude protein (CP), crude fibre (CF), calcium (Ca), and phosphorus (P). Super Napier recorded the highest CP (10.14%), calcium (0.39%), and phosphorus (0.20%), along with superior digestibility indicators, including total digestible nutrients (TDN, 65.09%), relative feed value (RFV, 106.55%), and relative forage quality (RFQ, 113.48%). Australian Red Napier exhibited the highest crude fibre (38.55%) and cellulose (29.00%), supporting its role in maintaining rumen health despite lower digestibility. Sorghum varieties, particularly CSV 33 MF, showed high hemicellulose content (30.01%), indicating potential for energy release through fermentation. This comprehensive evaluation underscores the potential of hybrid forages like Super Napier to address fodder scarcity and improve livestock productivity by offering high nutritional quality and digestibility.

Keywords: Bajra, Napier, multi cut sorghum, RFQ, RFV

Introduction
The livestock sector plays a vital role in the agricultural economy of India, contributing significantly to rural livelihoods and food security. However, the productivity of livestock in the country is constrained by several challenges, one of the most critical being the availability and quality of fodder. Despite the abundance of crop residues, there is a significant gap between the demand for high-quality fodder and its availability throughout the year (Rao *et al*, 2003) [20]. This issue becomes even more pronounced during periods of drought or low forage availability, which negatively affects the health, growth, and productivity of livestock.

In light of these challenges, identifying alternative and sustainable sources of high-quality fodder varieties is crucial for improving livestock productivity. Among the potential solutions, hybrid forages and perennial grasses have garnered attention for their ability to provide nutritious and cost-effective alternatives to traditional fodder. These resources, if properly utilized, can address the problem of fodder scarcity while also reducing dependence on expensive commercial feeds.

Nutritional evaluation of fodder crops is critical for optimizing feed formulations that cater to the specific needs of high-yielding dairy cattle, buffaloes, and other ruminants. Parameters such as crude protein (CP), crude fiber (CF), neutral detergent fiber (NDF), acid detergent fiber (ADF), and total digestible nutrients (TDN) are essential indicators of fodder quality. Moreover, indices like digestible dry matter (DDM), relative feed value (RFV), and relative forage quality (RFQ) provide insights into digestibility and energy availability, which are

key to improving animal performance in intensive and semi-intensive production systems

The aim of this study is to evaluate the nutritive value of selected forage species, such as Bajra Napier hybrid grass, BNH grass produces a higher yield of dry matter (DM), making it a popular tropical forage plant (Hanna *et al*., 2004) [9]. A promising perennial source of green fodder is Bajra Napier hybrid grass and it is widely used for its excellent yield, palatability, and tolerance to diverse soil and climatic conditions (Faruqui *et al*., 2009) [6]. Similarly, perennial sorghum has emerged as a valuable forage crop in India, offering resilience and high nutritional value (Pandey and Roy, 2011) [19]. Proper utilization of these forages can not only alleviate fodder scarcity but also reduce dependence on expensive commercial concentrate feeds. By assessing the chemical composition, digestibility, and overall nutritional quality of these forages, the experiment seeks to determine their suitability for inclusion in ruminant diets. This research will provide valuable insights into the potential of locally available forages to improve livestock feeding practices, ultimately contributing to enhanced animal performance and increased farm profitability.

Materials and Methods

Sample collection and preparation

Green fodder species of multicut Sorghum (CSV 33mf, CSH 24mf. SSG 59-3) Napier bajra hybrids (CO-4, Super Napier, Red Napier**,** and APBN-1) were harvested at the pre-blooming stage (first cut). Additionally, the whole plant of sorghum at the flowering stage, along with various Bajra Napier hybrid grasses at the pre-blooming stage, were collected for further evaluation from the plots at the Forage Unit, Department of Livestock Farm Complex, College of Veterinary Science, Hyderabad, Telangana. The region experiences hot dry summers, mild winters, and an average annual rainfall of 950 mm, located at 542.3 m altitude on 17.90°N latitude and 78.23°E longitude. For forage quality assessment, approximately 1 kg of samples were dried at 60 °C for 48 hours, ground with a Wiley mill to pass a 1 mm screen, and analyzed for proximate composition (AOAC, 2005) [1] and cell wall constituents (Van Soest *et al*., 1991). [30] Nutritional parameters like total digestible nutrients (TDN), dry matter intake (DMI), digestible dry matter (DDM), digestible crude protein (DCP), net energy for lactation (NEL), digestible feed energy (DFE), relative feed value (RFV), relative forage quality (RFQ), and digestible energy (DE) were estimated using equations adapted from Lithourgidis *et al*. (2006) [17], Lebas (2013) [16], and Kumar *et al*. (2016) [14]. Experiment was conducted in the year 2024 in the month of June.

1. Total digestible nutrients (TDN, %) = 87.84 − (0.7 × ADF)
2. Dry matter intake (DMI, % DM basis) = 120/NDF
3. Dry matter digestibility (DDM, %) = 88.9 – (0.779 × ADF)
4. Digestible crude protein (DCP, %) = (0.929 × CP) − 3.77
5. NE_l (M Cal/Kg)= (1.044-(0.0119x%ADF)) x2.205
6. Digestible feed energy (DFE, Mcal/kg) = 4.4 × (TDN/100)
7. Relative feed value (RFV, %) = (DDM × DMI)/1.29
8. Relative feed quality (RFQ, %) = (TDN × DMI)/1.23
9. Digestible Energy(DE) = 15.627 + 0.000982 (CP^2) + 0.0040 (EE^2) - 0.0114(Ash^2) - 0.169 (ADF) ± 1.250 MJ/kg DM

Statistical Analysis

Data was analysed by One-way-ANOVA using SPSS (version 20) and Duncan test (α=0.05) was used to compare the treatment means.

Results and Discussion

Chemical Composition of Fodder Species

The chemical composition of the evaluated fodder varieties (Table 1) revealed significant differences (p<0.05) in their nutrient content. Hybrid bajra Napier APBN-1 exhibited the highest moisture content (80.39%), followed by Super Napier (77.30%) (Babu *et al*., 2025) [2], while Sorghum CSV 33 MF had the lowest (59.33%), which could influence their suitability for various climates and storage conditions. Super Napier recorded the highest crude protein (CP) content (10.14%), it is because, as noted by Singh *et al*. (2000) [26], CP content in forages is positively correlated with soil fertility, making it suitable for livestock with high protein demands. Similar CP values for Hybrid Napier grass varieties have been reported in earlier studies (Srinivas Kumar *et al*, 2013) [28]. In contrast, lower (Sahoo *et al*, 2014) [23] and higher (Halim *et al*, 2013; Lounglawan *et al*, 2014; Kebede *et al*, 2011 and EziMasdia *et al*, 2019) [8, 18, 22, 5]. CP content was reported as compared to the CP content observed in the present study. This contrast in results may be due to change in soil profile (Singh *et al*, 2000) [26] and climatic condition (Kaewpila *et al*, 2020). Low CP in the present experiment may be due to dry and hot tropical condition attributed to the high structural whereas Sorghum CSV 33 MF had the lowest CP (6.21%) similar results was obtained by Kushwaha *et al*. (2018) [15], limiting its utility in protein-demanding feeding regimens. Australian Red Napier showed the highest crude fibre (CF) content (38.55%) (Haryani, 2021) [10], indicating its value for ruminant diets requiring more fiber, while Hybrid bajra Napier APBN-1 had the lowest CF (25.98%). Super Napier also had the highest total ash content (9.60%), reflecting a rich mineral profile, compared to Hybrid bajra Napier CO-4 with the lowest total ash (8.27%). Neutral detergent fiber (NDF) and acid detergent fiber (ADF) were highest in Australian Red Napier (68.48% and 41.40%, respectively), suggesting reduced digestibility compared to other varieties. Calcium content was significantly higher in Super Napier (0.39%), followed by Hybrid bajra Napier APBN-1 (0.38%), while Sorghum CSH-24-MF and CSV 33 MF had lower levels (0.29% and 0.31%, respectively), underscoring the value of Super Napier for supporting skeletal health and milk production. Similarly, phosphorus was highest in Super Napier (0.20%) and lowest in Sorghum CSV 33 MF (0.12%), with Super Napier presenting a superior Ca:P ratio for optimal nutrient metabolism. Australian Red Napier had the highest cellulose content (29.00%), followed by Hybrid bajra Napier APBN-1 (28.44%), whereas Sorghum CSV 33 MF had the lowest (24.25%). High cellulose in Australian Red Napier aids in rumen function and microbial activity, despite slower digestibility. Hemicellulose was highest in Sorghum CSV 33 MF (30.01%) and lowest in Hybrid bajra Napier APBN-1 (19.90%), highlighting the potential of Sorghum CSV 33 MF for better energy release through microbial fermentation. Silica content was highest in Australian Red Napier (2.80%), followed by Super Napier (2.70%), while Sorghum CSV 33 MF had the lowest silica levels (1.70%). Elevated silica can reduce digestibility due to its structural role, though moderate levels in Super Napier ensure a balance between digestibility and structural integrity.

Table 1: Chemical composition (% DM basis)

	Fodder Variety	Table 1 Chemical composition (% DM basis)															
		Moisture	Dry Matter	Crude Protein	Crude Fat	Crude Fibre	Total Ash	NFE	AIA	Ca	P	NDF	ADF	Cellulose	ADL	Silica	Hemi Cellulose
1	Sorghum CSH-24-MF	76.62c±1.12	23.38c±0.28	7.21b±0.08	2.10c±0.05	33.00e±0.08	7.16c±0.08	50.63c±0.87	1.88a±0.05	0.29a±0.00	0.15b±0.00	67.55d±0.68	42.90f±0.34	25.68b±0.20	7.23d±0.04	2.80e±0.02	24.65c±0.16
2	Sorghum SSG-59-3	68.17b±0.99	31.83d±0.39	9.56f±0.11	2.40d±0.06	29.67c±0.07	6.04b±0.07	52.33c±0.90	1.97ab±0.05	0.29a±0.00	0.19c±0.00	61.77b±0.62	38.95d±0.31	28.44d±0.22	5.99b±0.03	1.77b±0.01	22.82b±0.15
3	Sorghum CSV 33 MF	59.33a±0.86	40.67d±0.49	6.21a±0.07	1.80b±0.04	30.21d±0.07	4.06a±0.05	57.82d±0.99	1.87a±0.05	0.31b±0.00	0.12a±0.00	64.06c±0.65	34.05b±0.27	24.25a±0.19	5.90b±0.03	1.70a±0.01	30.01f±0.19
4	Hybrid bajra Napier APBN-1	80.39d±1.17	19.61a±0.24	8.11d±0.10	1.24a±0.03	25.98a±0.06	8.63e±0.10	56.04d±0.96	2.70c±0.07	0.38c±0.00	0.19c±0.00	55.60a±0.56	35.70c±0.28	29.00d±0.22	5.50a±0.03	2.70d±0.02	19.90a±0.13
5	Hybrid bajra Napier Super Napier	77.30cd±1.13	22.70c±0.27	10.14e±0.10	1.38a±0.03	35.98f±0.09	9.60g±0.11	44.50b±0.76	2.10b±0.05	0.39d±0.00	0.20e±0.00	55.00a±0.55	32.50a±0.26	24.00a±0.19	5.90b±0.03	2.15c±0.01	22.50b±0.14
6	Hybrid bajra Napier CO-4	78.35cd±1.14	21.65b±0.26	7.80c±0.09	1.77b±0.04	29.03b±0.07	8.27d±0.10	53.13c±0.91	1.90a±0.05	0.31c±0.01	0.15b±0.00	68.90d±0.69	40.78e±0.32	25.60b±0.20	6.20c±0.03	1.80b±0.01	28.12e±0.18
7	Hybrid bajra Napier Australian Red Napier	76.76c±1.12	23.24c±0.28	8.31g±0.13	2.60e±0.06	38.55g±0.09	9.10f±0.11	38.43a±0.66	3.10d±0.08	0.30b±0.01	0.19d±0.00	68.48d±0.69	41.40e±0.33	26.34c±0.20	7.80e±0.04	2.80e±0.02	27.08d±0.17
	Mean ± SE	73.85±1.58	26.15±1.55	8..38±0.35	1.88±0.10	1.77±0.90	7.55±0.41	50.41±1.43	2.22±0.10	0.41±0.04	0.17±0.01	63.05±1.23	38.04±0.83	26.19±0.40	6.36±0.17	2.25±0.11	25.01±0.74

a, b, c, d, e, f, g Values bearing different superscripts in a column differ significantly (p<0.05)

Table 2: Estimated digestibility parameters and quality in percent of the various fodder varieties

	Fodder Variety	TDN %	DMI % DM BASIS	DDM%	DCP%	NE L Mcal/Kg	DFE Mcal/kg	RFV%	RFQ%	DE
1	Sorghum CSH-24-MF	57.81a±0.24	1.78a±0.02	55.48a±0.26	2.93a±0.08	1.18a±0.01	2.54a±0.01	76.98a±0.43	83.50a±0.52	9.11a±0.04
2	Sorghum SSG-59-3	60.58c±0.21	1.94c±0.02	58.56c±0.24	5.11f±0.10	1.28c±0.01	2.67c±0.01	88.20b±0.55	95.69b±0.65	9.99c±0.04
3	Sorghum CSV 33 MF	64.01e±0.19	1.87b±0.02	62.38e±0.21	2.71a±0.07	1.41e±0.01	2.82e±0.01	90.59c±0.63	98.49b±0.72	10.98e±0.04
4	Hybrid bajra Napier APBN 1	62.85d±0.20	2.16d±0.02	61.09d±0.22	3.76d±0.09	1.37d±0.01	2.77d±0.01	102.22d±0.69	101.30b±0.79	10.07c±0.03
5	Hybrid bajra Napier Super Napier	65.09f±0.18	1.75a±0.02	56.65b±0.25	6.75g±0.09	1.22b±0.01	2.59b±0.01	106.55e±0.77	113.48d±0.87	9.09a±0.04
6	Hybrid bajra Napier CO-4	59.29b±0.22	1.74a±0.02	57.13b±0.25	3.48c±0.08	1.23b±0.01	2.61b±0.01	77.14a±0.46	83.97a±0.55	9.28b±0.04
7	Hybrid bajra Napier Australian RED NAPIER	58.86b±0.23	2.18d±0.02	63.58f±0.20	4.16e±0.12	1.45f±0.01	2.86f±0.01	76.40a±0.45	83.87a±0.54	10.41d±0.02
	Mean±SE	61.21±0.58	1.92±0.04	59.27±0.65	4.01±0.32	1.30±0.02	2.69±0.03	88.44±2.63	95.76±2.73	9.85±0.15

a, b, c, d, e, f, g Values bearing different superscripts in a column differ significantly (p<0.05)

The digestibility and quality parameters (Table 2) further emphasize the variability among the evaluated fodder varieties, highlighting their suitability for different livestock needs. Super Napier exhibited the highest total digestible nutrients (TDN) content (65.09%), signifying its superior energy availability, while Sorghum CSH-24-MF recorded the lowest TDN (57.81%). Similarly, Super Napier outperformed other varieties in relative feed value (RFV) and relative forage quality (RFQ), with values of 106.55% and 113.48%, respectively (Fekadu *et al*, 2017 and Dunham, 1998) [7, 4], establishing it as an excellent choice for high-producing animals. The RFV index estimates the digestible dry matter (DDM) from ADF, and calculates the DM intake potential (as a percent of body weight, BW) from NDF. RFV is an accurate measure for quality over protein content alone which provides an indication of digestibility and how much forage an animal can eat.

RFQ (Sheaffer *et al*., 1995; Ball *et al*., 2007) [25, 3]. The RFQ index includes the differences in digestibility of the fiber fraction and can be used to more accurately guess animal performance and match animal needs. The recorded Relative Forage Quality (RFQ) percent was 98.60. In this context it has to be noted that as per Undersander, 2003 [29], RFQ must be from 100 to 200 in order to support Cattle Type of Heifer and 18 to 24 months dry cow. While the RFQ-based Forage Quality Grading system given by Saha *et al*, 2024 [22] classifies the RFQ of >185 as Supreme and RFQ of <90 as Utility. Australian Red Napier demonstrated the highest digestible dry matter (DDM) at 63.58%, indicating enhanced forage quality, while Sorghum CSH-24-MF exhibited the lowest DDM (55.48%). Digestible crude protein (DCP) was also highest in Super Napier (6.75%), enhancing its appeal for lactating animals requiring higher protein levels. Furthermore, Super Napier recorded superior energy parameters, including net energy (Ravindra Dombar *et al*., 2022) [21] for lactation (NEL) at 1.45 Mcal/kg and digestible energy (DE) at 10.41 Mcal/kg, underscoring its high energy content and suitability for meeting the nutritional demands of high-performing livestock.

Conclusion

This study provides valuable insights into the nutritional composition and digestibility of selected fodder species, including Bajra Napier hybrids and sorghum varieties. Significant variations were observed among the species for key nutrients and digestibility parameters. Super Napier emerged as a promising candidate due to its high CP, Ca, and P content, along with superior TDN, RFV, and RFQ values. Australian Red Napier demonstrated high CF and cellulose content, beneficial for rumen health. Sorghum varieties exhibited high hemicellulose content, indicating potential for energy release through fermentation. These findings emphasize the importance of selecting appropriate fodder species based on specific livestock requirements and production systems. Utilizing high-quality forages like Super Napier can significantly enhance livestock productivity, improve animal health, and contribute to the economic sustainability of the livestock sector in India. Further research is recommended to evaluate the *in vivo* performance of these forages on different livestock categories under varying agro-climatic conditions.

References

1. AOAC. Official methods of analysis. 18th ed. Association of Official Analytical Chemists; 2005.
2. Babu AS, Krishna CR, Sagi Raju B, Kumar S, Reddy DR. Evaluation of super Napier (*Pennisetum purpureum* × *P. glaucum*) green fodder and silage quality harvested at various days after planting as ruminant fodder. International Journal of Advanced Biochemistry Research. 2025;SP-9(1):223-227.
3. Ball DM, Hoveland CS, Lacefield GD. Adapted from Southern forages. 4th ed. International Plant Nutrition Institute; 2007.
4. Dunham JR. Relative feed value measures forage quality. Forage Facts. 1998;41(3).
5. EziMasdia P, Mardiati Zain L, Lili W, Hermon H. *In vitro* evaluation of ruminant feed from West Sumatera based on chemical composition and content of rumen degradable and rumen undegradable proteins. Veterinary World. 2019;12(9):1478-1483.
6. Faruqui A, Hledik R, Tsoukalis J. The power of dynamic pricing. The Electricity Journal. 2009;22(3):42-56.
7. Fekadu D, Walelegn M, Terefe G. Indexing Ethiopian feedstuffs using relative feed value: Dry forages and roughages, energy supplements, and protein supplements. Journal of Biology, Agriculture and Healthcare. 2017;7(21):2224-3208.
8. Halim RA, Shampazuraini S, Idris AB. Yield and nutritive quality of nine Napier grass varieties in Malaysia. Malaysian Journal of Animal Science. 2013;16:37-44.
9. Hanna WW, Chaparro CJ, Mathews BW, Burns JC, Sollenberger LE, Carpenter JR. Perennial Pennisetums. In: Moser LE, Burson BL, Sollenberger LE, editors. Warm-season (C4) grasses. American Society of Agronomy; 2004. p. 503-535.
10. Haryani H, Norlindawati AP, Aswanimiyuni A, Nurzillah M, Saiful SM. Cutting age effects on yield and nutritive values of Napier Pakchong (*Cenchrus purpureus* cv. Pakchong). Malaysian Journal of Veterinary Research. 2021;12(2):46-51.
11. Kebede G, Feyissa F, Assefa G, Alemayehu M, Mengistu A, Kehaliew A, *et al*. Chemical composition and in-vitro organic matter digestibility of Napier grass (*Pennisetum purpureum* L.). Journal of Experimental Zoology India. 2022;25:279-282.
12. Khaing KT, Loh TC, Ghizan S, Halim RA, Samsudin AA. Feed intake, growth performance and digestibility in goats fed whole corn plant silage and Napier grass. Malaysian Journal of Animal Science. 2015;18(1):87-97.
13. Kiyothong K. Miracle grass seen to boost local dairy production. Pinoy Feeds [Internet]. 2014. Available from: ww.pinoyfeeds.com/super-napier.html.
14. Kumar B, Dhaliwal SS, Singh ST, Lamba JS, Ram H. Herbage production, nutritional composition, and quality of teosinte under Fe fertilization. International Journal of Agriculture & Biology. 2016;18(2).
15. Kushwaha M, Singh M, Kumar R, Tyagi N, Soni PG, Choudhary S, *et al*. Yield and quality of multicut fodder sorghum as affected by nutrient levels and biofertilizer application. Indian Journal of Animal Nutrition. 2018;35(1):82-89.
16. Lebas F. Estimation de la digestibilité des protéines et de la teneur en énergie digestible des matières premières pour le lapin, avec un système d'équations.

Proceedings of the 15èmes Journées de la Recherche Cunicole; Le Mans, France; 27-30.
17. Lithourgidis AS, Vasilakoglou IB, Dhima KV, Dordas CA, Yiakoulaki MD. Forage yield and quality of common vetch mixtures with oat and triticale in two seeding ratios. Field Crops Research. 2006;99(2-3):106-113.
18. Lounglawan P, Wassana L, Wisitiporn S. Effect of cutting interval and cutting height on yield and chemical composition of King Napier grass (*Pennisetum purpureum* × *Pennisetum americanum*). APCBEE Procedia. 2014;8:27-31.
19. Pandey KC, Roy AK. Forage crops varieties. IGFRI; 2011.
20. Rao PP, Hall AJ. Importance of crop residues in crop–livestock systems in India and farmers' perceptions of fodder quality in coarse cereals. Field Crops Research. 2003;84(1-2):189-198.
21. Ravindra Dombar B, Ramachandra T, Thirumalesh S, Kulkarni S, Suranagi MD, Patil V, *et al*. Dry matter intake, nutritive value, and digestibility of Super Napier fed to adult Kenguri sheep. Journal of Experimental Zoology India. 2022;25:279-282.
22. Saha U, Hancock D, Kissel D. How do we calculate relative forage quality in Georgia. Agricultural and Environmental Services Laboratories Cooperative Extension Service; 2014.
23. Sahoo B, Garg AK, Mohanta RK, Thirumurgan P, Sharma AK, Pandey AB. *In vitro* nutritional evaluation of marginal land grasses of temperate sub-Himalayas. Indian Journal of Animal Nutrition. 2014;31(3):256-261.
24. Schumacher A. Accessions in the mid and highland areas of Ethiopia. International Journal of Livestock Research. 2016;6(4):41-59.
25. Sheaffer CC, Peterson MA, McCalin M, Volene JJ, Cherney JH, Johnson KD, *et al*. Acid detergent fiber, neutral detergent fiber concentration, and relative feed value. Proceedings of the North American Alfalfa Improvement Conference; Minneapolis; 1995 Mar.
26. Singh D, Singh V, Joshi YP. Effect of nitrogen fertilization and cutting intervals on yield and quality of Napier Bajra hybrid. Range Management and Agroforestry. 2000;21:128-134.
27. SK T. The analysis of mineral constituents in biological materials. Indian Journal of Veterinary Science and Animal Husbandry. 1940;10:243-246.
28. Srinivas Kumar D, Venkateswarlu S, Raja Kishore K. Effect of supplementation of milk dhara on milk yield and milk composition in graded Murrah buffaloes. Journal of Advanced Veterinary Research. 2013;3:89-92.
29. Undersander D. The new relative forage quality index—concept and use. University of Wisconsin Extension; 2003.
30. Van Soest PV, Robertson JB, Lewis BA. Methods for dietary fiber, neutral detergent fiber, and nonstarch polysaccharides in relation to animal nutrition. Journal of Dairy Science. 1991;74(10):3583-3597.