NUTRITIONAL COMPOSITION OF PASTURE SPECIES AS AFFECTED BY VARIETY AND COW DUNG APPLICATION RATES

Abubakar, U.I. [1]*, Ibrahim, A. .[2], Haruna, I.M.[1], Jibrin, I. M.[1], Baba, M. K.[3], Abdullahi, S.[2] and Idahor K.O.[3]

[1]Department of Agronomy, Faculty of Agriculture, Nasarawa State University, Keffi, Nigeria
[2]Department of Agronomy, Faculty of Agriculture, Federal University of Lafia, Nigeria
[3]Department of Animal Science, Faculty of Agriculture, Nasarawa State University, Keffi, Nigeria
*Corresponding author: umarabubakaribrahim34@gmail.com; +2347038667393

ABSTRACT

The nutritional composition of pasture species is essential for sustainable livestock production, influenced by genetic variation and soil fertility management. This study evaluated the effects of different cow dung application rates (0, 5, and 10 t/ha) on the nutritional composition of six pasture varieties (NAPRI gamba, Local gamba, NAPRI kyasuwa, Local kyasuwa, NAPRI guinea, and Local guinea) in Lafia, Southern agroecological zone of Nasarawa State, Nigeria. The experiment was conducted using a randomized complete block design with three replications in a factorial arrangement. Moisture content (MC), ash, crude protein (CP), ether extract (EE), crude fiber (CF), and nitrogen-free extract (NFE) were assessed. Results revealed significant (P<0.05) differences in nutrient composition across pasture varieties and cow dung application rates. NPM had the highest MC (3.42%), while NMM had the lowest (3.34%). The highest CP content was observed in NGM (21.29%), and the lowest in LGM (5.93%). Ash content varied from 15.66% in NMM to 9.20% in NPM. The highest EE content was found in NMM (10.97%) and the lowest in NGM (5.79%). LGM exhibited the highest CF content (11.22%), while NGM had the lowest (9.26%). The highest NFE content was recorded in NPM (63.90%). The interaction between cow dung rates and pasture variety significantly (p≤ 0.05) influenced all nutritional parameters. These findings emphasize the importance of pasture selection and organic fertilization in optimizing forage quality for sustainable livestock production.

Keywords: Pasture nutrition, Cow dung, Forage quality, Crude protein, Variety

INTRODUCTION

Pasture species play a critical role in livestock production by providing essential nutrients for animal growth and health. Their nutritional composition is influenced by genetic variation and soil fertility management. Cow dung, a nutrient-rich organic amendment, enhances soil fertility and promotes pasture growth due to its nitrogen, phosphorus, and potassium content (Ratikul *et al*., 2023; Patra and Bharti, 2024). It also improves pasture biomass yield and nutritional quality, affecting crude protein, fiber composition, and mineral availability (Patra and Bharti, 2024). However, the response of different pasture varieties to varying cow dung application rates remains underexplored. Understanding this interaction is crucial for optimizing forage quality and ensuring balanced nutrient intake for grazing animals. This study evaluated the effects of cow dung application on the nutritional composition of pasture species in Lafia, Southern agroecological zone of Nasarawa State, Nigeria.

MATERIALS AND METHODS

The field experiment was conducted at the Teaching and Research Farm, Faculty of Agriculture, Nasarawa State University Keffi, during the June–September 2023 cropping season. The study area falls within the Southern Guinea Savanna zone of Nigeria, characterized by an annual rainfall range of 1100–2000 mm and a temperature range of 20 - 30°C (NIMET, 2023). The experiment followed a randomized complete block design (RCBD) with three replications in a factorial arrangement. It comprised six pasture varieties (NAPRI gamba, Local gamba, NAPRI kyasuwa, Local kyasuwa, NAPRI guinea, and Local guinea) and three cow dung application rates (0, 5, and 10 t/ha), totaling 54 plots. Nutritional composition was analyzed through proximate analysis, assessing MC, ash, CP, EE, CF, and NFE using standard laboratory procedures. Data were analyzed using ANOVA with significance at p≤ 0.05, and means were separated using LSD (SAS 9.4, 2013).

RESULTS AND DISCUSSION

The study revealed significant effects of cow dung application and pasture variety on nutrient composition. The highest MC was recorded in NPM (3.42%) and the lowest in NMM (3.34%). Cow dung rates of 0 and 5 t/ha yielded higher MC (3.39%) compared to 10 t/ha (3.38%). Ash content varied from 15.66% in NMM to 9.20% in NPM, influenced by cow dung's ability to enhance mineral availability. NGM exhibited the highest CP content (21.29%), while LGM had the lowest (5.93%), reflecting the impact of nitrogen availability from manure application (Williams and Ojo, 2022). EE content was highest in NMM (10.97%) and lowest in NGM (5.79%). LGM had the highest CF content (11.22%), while NGM had the lowest (9.26%). The highest NFE content was observed in NPM (63.90%), confirming the role of organic fertilization in improving carbohydrate reserves in pasture. The interaction between pasture variety and cow dung application significantly influenced all nutritional parameters, demonstrating the importance of optimizing organic fertilization strategies for enhanced forage quality (Seeiso and Materechera, 2014).

Table 1. Nutrient Composition of Weed Pasture

Varieties	%MC	%Ash	%CP	%EE	%CF	%NFE
NAPRI Gamba grass	3.39[c]	14.12[c]	21.29[a]	5.79[f]	9.26[f]	46.88[e]
Local Gamba grass	3.36[e]	14.58[b]	5.93[f]	7.63[b]	11.22[a]	57.34[b]
NAPRI Kyasuwa grass	3.42[a]	9.20[f]	6.99[e]	7.16[c]	9.33[e]	63.90[a]
Local Kyasuwa grass	3.41[b]	12.44[d]	13.86[c]	5.79[e]	10.46[b]	54.07[d]
NAPRI Guinea grass	3.34[f]	15.66[a]	14.87[b]	10.97[a]	9.58[d]	45.59[f]
Local Guinea grass	3.38[d]	11.35[e]	12.11[d]	6.28[d]	10.21[c]	56.72[c]
SE	0.003	0.004	0.005	0.004	0.004	0.004
LSD	0.007	0.009	0.011	0.009	0.009	0.008
Cow dung (t/ha)						
0	3.39[a]	12.72[b]	12.47[b]	6.99[c]	9.79[c]	54.55[b]
5	3.39[a]	12.57[c]	12.07[c]	7.13[b]	9.90[b]	55.00[a]
10	3.38[b]	13.38[a]	12.98[a]	7.22[a]	10.33[a]	52.70[c]
SE	0.002	0.003	0.003	0.003	0.003	0.003
LSD	0.005	0.006	0.008	0.006	0.009	0.006
Interaction						
Varieties*Cow dung	*	*	*	*	*	*

MC% = Moisture content percentage; Ash% = Ash percentage; CP%=Crude protein; EE%=Ether extract; CF%=Crude fibre; NFE%=Nitrogen free extract. P≤0.05**, NS= not significant; means with the same letters are not significantly different.

The highest EE content recorded for NMM at 10.97% suggests a favorable nutritional profile, aligning with findings that organic amendments enhance crop quality (Dania *et al*., 2014). Conversely, NGM's lower EE content of 5.79% may indicate suboptimal nutrient uptake or soil conditions, consistent with studies on soil amendments affecting nutrient availability (Ferreira *et al*., 2020). The highest EE content at 10 t/ha (7.22%)

Table 2. Interaction between Cow Manure Application Rate and Variety on Nutrient Composition of Weed Pasture

Interaction	%MC	%Ash	%CP	%EE	%CF	%NFE
NAPRI Gamba grass*0	3.34	14.36	17.94	2.26	9.36	52.15
NAPRI Gamba grass*5	3.45	15.95	28.44	6.53	11.07	34.57
NAPRI Gamba grass *10	3.41	12.05	17.51	5.76	7.35	53.93
Local Gamba grass*0	3.35	18.81	6.14	6.92	11.61	54.08
Local Gamba grass*5	3.10	13.12	5.17	6.45	11.74	60.16
Local Gamba grass*10	3.43	11.82	6.14	10.42	10.33	57.77
NAPRI Kyasuwa grass*0	3.41	12.63	5.24	5.87	7.54	65.32
NAPRI Kyasuwa grass*5	3.42	3.73	6.55	8.14	8.15	70.02
NAPRI Kyasuwa grass*10	3.45	11.24	9.18[j]	7.47	12.32	56.36
Local Kyasuwa grass*0	3.51	11.53	24.07	7.93	10.19	42.79
Local Kyasuwa grass*5	3.32	11.34	3.96	7.45	11.83	62.17
Local Kyasuwa grass*10	3.38	14.46	13.55	1.99	9.36	57.26
NAPRI Guinea grass*0	3.32	13.41	12.6	11.12	12.04	47.46
NAPRI Guinea grass*5	3.42	18.18	19.68	10.36	5.57	42.79
NAPRI Guinea grass*10	3.28	15.39	12.25	11.45	11.12	46.53
Local Guinea grass*0	3.41	5.59	8.76	8.73	8.04	65.51
Local Guinea grass*5	3.41	13.12	8.32	3.86	11.05	60.29
Local Guinea grass*10	3.32	15.36	19.26	6.23	11.54	44.36
LSD	0.013	0.016	0.020	0.017	0.016	0.015

MC% = Moisture content percentage; Ash% = Ash percentage; CP%=Crude protein; EE%=Ether extract; CF%=Crude fibre; NFE%=Nitrogen free extract. P≤0.05*, NS= not significant; means with the same letters are not significantly different underscores the role of organic fertilizers in improving crop nutrition, supporting research on organic manure enhancing nutrient concentration (Ma et al., 2021). The lowest EE content at 0 t/ha (6.99%) further highlights the necessity of manure application for optimal nutrient accumulation (Basnet et al., 2018). In terms of crude fiber, LGM recorded the highest (11.22%) and NGM the lowest (9.26%), reflecting varietal differences in fiber accumulation influenced by genetic and environmental factors (Biel *et al*., 2016). An increase in CF to 10.33% at 10 t/ha suggests that organic amendments not only aid nutrient uptake but also strengthen plant structure (Asaolu *et al*., 2012). The lower CF at 0 t/ha (9.79%) further supports the importance of organic matter in fiber development (Adekiya, 2019). NFE, NPM recorded the highest (63.90%) and the lowest was 45.59%, showing treatment-induced variability. The highest NFE at 5 t/ha (55.00%) suggests that moderate organic fertilizer applications may optimize nutrient uptake better than excessive rates, which can cause nutrient dilution (Valadares *et al*., 2020). The lower NFE at 10 t/ha (52.70%) may indicate a nutrient saturation threshold limiting uptake efficiency (Yang and Ha, 2013).

The interaction between cow manure rates and pasture varieties significantly ($p \leq 0.05$) affected MC, ash, CP, EE, CF, and NFE. The highest MC was in LPM at 0 t/ha (3.51%), while the lowest was in NMM at 10 t/ha (3.28%). Ash content ranged from 18.81% in LGM at 0 t/ha to 3.73% in NPM at 5 t/ha. Crude protein was highest in NGM at 5 t/ha (28.44%) and lowest in LPM at 5 t/ha (3.96%). The highest EE was in NMM at 10 t/ha (11.45%), while LPM had the lowest (1.99%) at the same manure rate. CF peaked in NPM at 12.32% at 10 t/ha, while the lowest was in Local Guinea (8.04%) at 0 t/ha. NPM had the highest NFE (70.02%) at 5 t/ha, whereas LPM and NMM recorded the lowest at 0 and 5 t/ha (42.79%), respectively. These results reinforce the importance of organic fertilization in optimizing forage quality.

CONCLUSION

This study demonstrated that pasture variety and cow dung application rates significantly affected nutritional composition, with 10 t/ha of cow manure enhancing CP, CF, and EE. A moderate application rate (5 t/ha) improved NFE. The significant interaction between cow dung rates and pasture varieties highlights the importance of strategic fertilization to optimize forage quality. Integrating organic amendments into pasture management can promote sustainable livestock production and improve soil fertility.

REFERENCES

Adekiya, A. (2019). Green manures and poultry feather effects on soil characteristics, growth, yield, and mineral contents of tomato. *Scientia Horticulturae*, 257, 108721. https://doi.org/10.1016/j.scienta.2019.108721

Asaolu, S., Adefemi, O., Oyakilome, I., Ajibulu, K., and Asaolu, M. (2012). Proximate and mineral composition of Nigerian leafy vegetables. *Journal of Food Research*, 1(3), 214. https://doi.org/10.5539/jfr.v1n3p214

Biel, W., Stankowski, S., Jaroszewska, A., Pużyński, S., and Bośko, P. (2016). The influence of selected agronomic factors on the chemical composition of spelt wheat (*Triticum aestivum* ssp. *spelta* L.) grain. *Journal of Integrative Agriculture*, 15(8), 1763-1769. https://doi.org/10.1016/s2095-3119(15)61211-4

Dania, S., Akpansubi, P., and Eghagara, O. (2014). Comparative effects of different fertilizer sources on the growth and nutrient content of moringa (*Moringa oleifera*) seedling in a greenhouse trial. Advances in Agriculture, 2014, 1-6. https://doi.org/10.1155/2014/726313

Ferreira, L., Viñales, M., Silva, L., and Lannes, L. (2020). Effects of animal manure upon growth of cerrado plants. Revista Ibero-Americana De Ciências Ambientais, 11(4), 81-88. https://doi.org/10.6008/cbpc2179-6858.2020.004.0007

Ma, D., Tian, X., Guo, P., Wang, L., and Teng, W. (2021). Effect of yield and quality of *Erythropalum scandens* BL under different dosage and proportion of chicken manure and cow manure. https://doi.org/10.21203/rs.3.rs-1054830/v1

Nigerian Meteorological Agency, College of Agriculture Lafia 2023

Patra, D. and Bharti, N. (2024). Revitalizing agriculture: role of cow dung and urine in promoting sustainability. Bhartiya Krishi Anusandhan Patrika, (Of). https://doi.org/10.18805/bkap696

Ratikul, R., Seviset, S., and Egwutvongsa, S. (2023). Green economy: development of sustainable dairy cow manure utilization processes for farmers in the northeastern region of thailand. *Academic Journal of Interdisciplinary Studies*, 12(2), 195. https://doi.org/10.36941/ajis-2023-0042

SAS (Statistical Analysis System), 2013. SAS Institute Inc. SAS/STAT 9.4 User's guide. Cary, NC, SAS Institute, USA, 2008.

Seeiso, M. and Materechera, S. (2014). Biomass yields and crude protein content of two african indigenous leafy vegetables in response to kraal manure application and leaf cutting management. *African Journal of Agricultural Research*, 9(3), 397-406. https://doi.org/10.5897/ajar2013.7139

Valadares, S., Valadares, R., Costa, C., Martins, E., and Fernandes, L. (2020). Nitrogen sources on yield, mineral nutrition and bromatology of cyclanthera pedate. Horticultura Brasileira, 38(1), 78-82. https://doi.org/10.1590/s0102-053620200112

Williams, T. and Ojo, V. (2022). Acceptability of *Pennisetum purpureum* by west african dwarf rams as influenced by manure application rates. *International Journal of Agriculture Environment and Food Sciences*, 6(4), 502-506. https://doi.org/10.31015/jaefs.2022.4.1

Yang, Z. and Ha, L. (2013). Analysis and comparison of nutrient contents in different animal manures from beijing suburbs. Agricultural Sciences, 04(12), 50-55. https://doi.org/10.4236/as.2013.412a005