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Comparative Analysis of Green, Red, and Mixed Napier Grass *(Cenchrus purpureus)* - Based Feed Formulations on the Growth Performance of Upgraded Dorper Sheep

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Abstract

This study compared the effects of green, red, and mixed Napier grass-based feed formulations on the growth performance of upgraded Dorper sheep in Calanasan, Apayao. A total of six sheep were assigned to three treatments using a completely randomized design. Data on feed intake, growth performance, and health indicators were collected over 30 days. Results showed that the mixed Napier grass formulation resulted in higher feed intake and better growth performance compared to the single-variety diets. All treatments maintained acceptable health conditions. However, due to the small sample size and short duration, the findings should be interpreted with caution. Further studies with larger samples and longer duration are recommended.

Keywords: Napier grass, Dorper sheep, feed formulation, growth performance, Calanasan, Apayao

INTRODUCTION

Napier grass (Cenchrus purpureus), commonly known as elephant grass, is widely used in tropical ruminant feeding systems due to its high biomass yield, adaptability, and year-round availability. It plays a vital role in smallholder livestock production, often serving as the primary forage source (Islam et al., 2023). However, high yield does not always correspond to high nutritional quality. Studies show that Napier grass alone is insufficient to meet the full nutritional requirements of ruminants due to limitations in crude protein and energy content (Frontiers in Plant Science, 2023; PMC, 2025).

The nutritional composition of Napier grass varies depending on cultivar, maturity, and management. It typically contains low to moderate crude protein and relatively high fiber, which can limit intake and nutrient utilization (Islam et al., 2023). Younger plants have higher protein and digestibility, while older plants become more fibrous due to lignification (Roy et al., 2025; Widiyastuti, 2014). When harvested at the same stage, Red and Green Napier grass show similar fiber compositions, including comparable NDF, ADF, and crude fiber levels, indicating their suitability as roughage

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sources (Negawo et al., 2017; Islam et al., 2023; Zailan et al., 2018).

Despite similarities, varietal differences exist. Green Napier often has a higher leaf-to-stem ratio and better digestibility, while Red Napier provides more stable nutrient content and higher biomass (Zailan et al., 2025; Frontiers in Plant Science, 2023). Digestibility remains moderate, which may limit performance when fed alone (PMC, 2025).

Thus, supplementation is necessary. Feeding Napier grass with concentrates improves intake, digestibility, and growth (ScienceDirect, 2008; Islam et al., 2023). Overall, proper management, harvest timing, and supplementation are essential to maximize its feeding value.

Interestingly, the municipality of Calanasan, Apayao, ruminant production—particularly cattle, goats, and sheep—plays a crucial role in the local agricultural economy and food security. However, productivity remains constrained by traditional feeding practices and the inconsistent availability and quality of forage. The Japan International Research Center for Agricultural Sciences (2024) reports that the utilization of local feed resources in the Philippines is often limited by seasonal variations that negatively affect forage nutritive value.

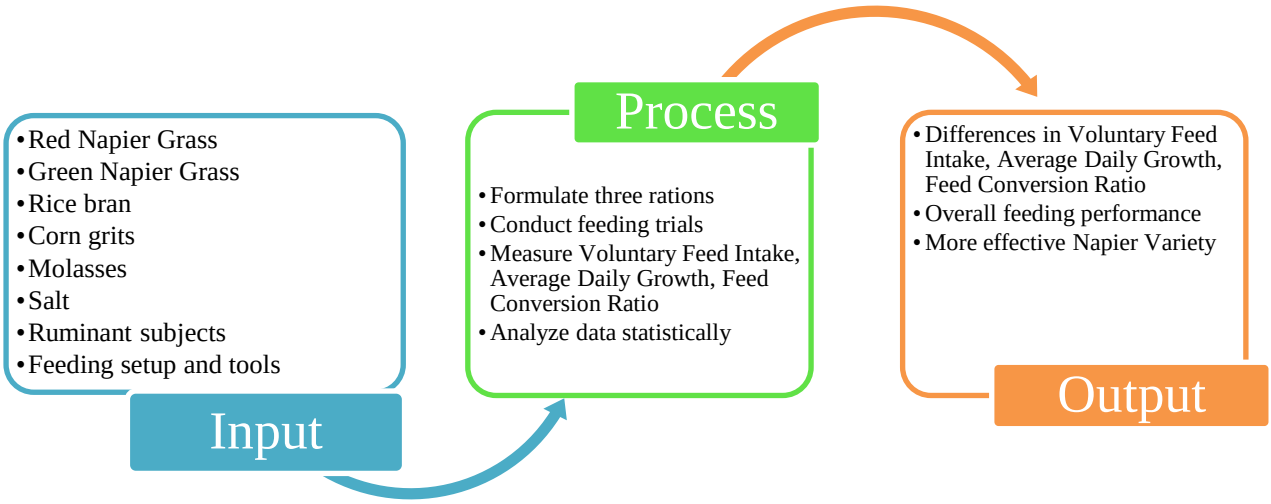
Modern livestock nutrition emphasizes the adoption of Total Mixed Ration (TMR) systems to improve animal performance and feed efficiency. According to the University of Minnesota Extension (2025), TMR ensures that each mouthful consumed contains a uniform and balanced nutrient composition, thereby preventing selective feeding or "sorting" behavior and promoting optimal nutrient intake.

Napier grass (*Cenchrus purpureus*) serves as the primary forage in small ruminant production systems due to its high biomass yield, adaptability, and resilience under tropical conditions. The Agricultural Training Institute–CAR (2022) identifies Napier grass as the backbone of small ruminant feeding systems in the Cordillera Administrative Region. In Calanasan, two varieties—Green Napier and Red Napier—are commonly cultivated. While Green Napier has long been the conventional forage of choice, Red Napier has recently gained attention due to its distinct morphological traits and potential agronomic advantages.

Studies indicate that different Napier grass cultivars exhibit significant variation in proximate composition, particularly in crude protein and fiber fractions, which directly influence digestibility and animal performance (Biochemistry Journal, 2025). Despite the widespread local use of both Green and Red Napier grass, there is limited quantitative evidence comparing their nutritional value and performance when incorporated into practical mixed rations containing locally available supplements such as rice bran, corn grits, and molasses. The Malaysian Journal of Veterinary Research (2024) emphasizes that forage nutritive value is highly dependent on variety and stage of harvest, underscoring the need for localized feeding trials.

This study sought to address this gap by comparing Green and Red Napier grass harvested at the same maturity stage and incorporated into Napier-based mixed rations. By analyzing chemical composition and evaluating animal performance indicators—including feed intake, body condition score, and average daily gain—this research aims to provide evidence-based recommendations to improve forage selection and feeding efficiency. According to MDPI Animals (2025), such comparative forage studies are essential for identifying varieties that optimize feed conversion efficiency under specific climatic and production conditions.

Conceptual Framework



The conceptual framework of this study illustrates how the type of Napier grass, as the main forage component in a mix ration, influences the feedings performance of ruminants. Inputs such as Napier variety, supplemental feed ingredients, experimental resources and are processed through ration formulation, feeding trials, and systematic data collection and analysis. The outputs, including voluntary feed intake, growth performance, feed efficiency, and held indicators, reflect the overall effect of Napier the variety on animal productivity. This framework provides a logical structure showing that differences in the forage input, when combined with a controlled feeding system, can directly impact

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ruminant performance and guide practical feedings recommendations.

Statement of the Problem

Ruminant producers in Calanasan need reliable, evidence-based guidance on forage selection and ration formulation to improve productivity. Red and Green Napier are both used locally, but direct quantitative comparisons of their performance as part of a practical mixed ration (with concentrates, rice bran, corn grits, molasses, and salt held constant) are lacking. Specifically, this study sought to answer the following:

1. What are the proximate fiber compositions of Red and Green Napier harvested at the same stage?
2. Is there a significant difference in total mixed ration intake when diets differ only by Napier variety?
3. Are there differences in basic health indicators (body condition score, fecal score) between animals on the three diets?
4. Is there a significant difference between the growth performance (average daily gain, total gain) and feed conversion ratio of animals fed with Green Napier grass, Red Napier grass and Mixed Green and Red Napier Grass diets?

METHODOLOGY

This chapter shows the methods and processes the researchers used in conducting the experiment. The research design, instrument used, data analysis, sampling technique, and locale of the study are also indicated.

Research Design

This study employed an experimental research design. It compared the effects of Green Napier grass, Red Napier grass, and Mixed feed formulation on the growth performance of upgraded Dorper sheep.

An experimental research design is appropriate for this study because the main objective is to determine the effect of different Napier grass varieties (Green and Red Napier) used in feed formulation on the growth performance of upgraded dorper sheep. This type of design allows the researcher to test cause-and-effect relationships, which is the main focus of the study.

Three dietary treatments were prepared. The only difference between the treatments was the Napier grass variety that was used. All other conditions are kept constant to ensure a fair comparison.

Locale of the Study

This study, titled " Comparative Analysis of Green, Red, and Mixed Napier Grass (*Cenchrus purpureus*) - Based Feed Formulations on the Growth Performance of Upgraded Dorper Sheep," was conducted at the Municipal Agriculture Farm Site, Poblacion, Calanasan, Apayao.

Calanasan is the largest municipality in Apayao, characterized by its vast mountainous terrain, lush forest cover, and a climate that remains relatively cool and moist throughout the year. According to the Provincial Government of Apayao (2024), these environmental conditions are highly conducive to forage production, particularly for high-yielding grasses like Napier, which thrive in fertile, well-watered upland soils.

The rearing of animals, particularly ruminants like cattle and sheep, is a traditional and expanding livelihood for the people of Calanasan. According to the Department of Agriculture - Cordillera Administrative Region (2023), the municipality's livestock sector is shifting from extensive, backyard-style grazing toward more intensified management systems to meet increasing local demand for meat. This transition highlights a critical need for localized research on feed efficiency. Because many farmers in Calanasan rely on "upgraded" breeds—such as the Dorper sheep used in this trial—the nutritional requirements are higher than those of native breeds, making the selection between Red and Green Napier varieties a matter of economic importance.

The feeding trial at the Salacpat site lasted for exactly 30 days, including a specific adjustment period to allow the sheep to acclimate to the Total Mixed Ration (TMR). This location was selected because its controlled environment reflects the actual climatic conditions under which Calanasan farmers operate, ensuring the study's results are directly applicable to the local community.

Instrumentation

The instruments that were used in this study included a digital livestock weighing scale to measure the body weight of the upgraded Dorper sheep and a feed weighing scale to record the amount of feed offered and feed refused daily. Individual feed troughs and water containers are provided to ensure accurate measurement of feed intake. Measuring tools were used during feed formulation to ensure correct proportions of ingredients, while data recording sheets or log books will be used to systematically record feed intake, body weight, and other necessary observations throughout the experimental period.

Sampling Procedure

Due to the limited availability of experimental animals in the study area, the research employed purposive sampling to select the experimental subjects. Six (6) upgraded Dorper sheep were deliberately chosen based on specific criteria, including similar age, sex, and initial body weight, to reduce biological variation that could confound the effects of the treatments. Selection of animals with comparable physiological characteristics ensured that differences in growth performance, feed intake, and body condition can be attributed more reliably to the type of Napier grass used rather than individual variation.

Following selection, the animals were randomly assigned to three treatment groups, with two sheep per treatment, using a Completely Randomized Design (CRD). Treatment 1 (T1) received a ration composed of Green Napier grass (GNG), Treatment 2 (T2) received a ration composed of Red Napier grass (RNG), and Treatment 3 (T3) received a mixed ration (MNG) combining both Green and Red Napier grass. Each treatment ration was formulated as a Total Mixed Ration (TMR), incorporating locally available supplements such as rice bran, corn grits, and molasses to ensure a balanced nutrient intake. Random assignment was ensured that each animal has an equal probability of receiving any treatment, reducing allocation bias and satisfying the assumptions of independence required for statistical analysis, particularly the Analysis of Variance (ANOVA) that will be employed in this study.

This sampling approach was particularly appropriate for this study because the municipality of Calanasan, Apayao, has a small population of upgraded Dorper sheep, reflecting the constraints typical of indigenous farming systems in the region. Purposive selection was allowed the researcher to focus on animals that are representative of the local production conditions, while random

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allocation will ensure scientific rigor despite the small sample size. Moreover, this approach was accommodated the realities of smallholder livestock production in Calanasan, where resources are limited, herd sizes are small, and farmers rely on traditional management practices. By combining purposive sampling with random assignment and defining specific treatment rations, the study was maintained internal validity while producing meaningful, context-specific insights into how Green and Red Napier grass affected the sheep performance under locally relevant conditions.

All experimental animals were individually identified and closely monitored throughout the study to ensure accurate measurement of growth performance parameters and to minimize potential confounding factors, thereby providing reliable and actionable data for local farmers and stakeholders.

Data Gathering Procedures

Data gathering was conducted throughout the duration of the feeding trial. Prior to the experiment, the sheep was dewormed and allowed an adjustment period to adapt to the feeds and housing conditions. Initial body weights were recorded at the start of the experiment. During the feeding period, the animals was fed with their assigned diets twice daily, and the amount of feed offered and feed refused was recorded daily to determine feed intake. Body weights were measured weekly using a weighing scale to monitor growth performance. All data was recorded every day for 1 month properly in data sheets for further analysis.

Statistical Tool

The data collected in this study was analyzed using Analysis of Variance (ANOVA) to determine whether significant differences exist among the treatment groups. ANOVA was employed to compare the effects of different Napier grass varieties and feeding treatments on the growth performance of upgraded Dorper sheep, including feed intake, body condition score, and average daily gain. This statistical tool is appropriate for evaluating differences among group means while controlling for random variation within treatments. A level of significance of 0.05 was used to test all hypotheses, and post hoc tests were conducted when significant differences are detected to identify specific treatment effects.

Ethical Considerations

The researchers strive to conduct the study with utmost integrity. In order to ensure such adherence to the moral codes, the following ethical considerations were followed:

Plagiarism under any form or type were avoided. The researchers vowed to acknowledge the intellectual property of their sources in the making of the research study.

Objectivity is a must. Research discussion, data analysis and interpretation and sampling procedures were executed without bias but with fairness.

The scope and limitations of the study were strictly followed. The researchers only studied the components relevant to the research objectives.

Results and Discussions

This section of the study presents the findings of the study on the comparative analysis of feed formulation using Green Napier Grass (GNG), Red Napier Grass (RNG), and a Mixed (MNG) Formulation of both grasses for the growth performance of Upgraded Dorper Sheep. The data collected during the feeding trial were carefully examined to determine how each type of feed formulation influenced the animals' growth and feed efficiency. Growth performance was evaluated using key indicators such as body weight gain, average daily gain, and feed intake of the sheep under the different feeding treatments.

Table 1. Proximate fiber composition of red Napier, green Napier grass and Mixed (green and red) Napier grass harvested at the same time.

Napier type	Crude Fiber (%)	NDF (%)	ADF (%)	Cellulose (%)	Hemicellulose (%)	Lignin (%)
Red Napier grass	28 – 32	60 – 65	35 - 40	25 - 30	20 - 25	6 - 8
Green Napier grass	27 – 31	58 – 63	34 - 38	24 - 29	19 - 24	5 - 7
Mixed (Red & Green) Napier grass	27 – 32	59 – 64	34 - 39	24 - 30	19 - 25	5 - 8

Table 1 shows the approximate fiber composition of Red Napier, Green Napier, and Mixed Napier grass harvested at the same time. Based on the data, Red Napier generally has slightly higher fiber content compared to Green Napier. This can be seen in its somewhat higher values of crude fiber, Neutral Detergent Fiber (NDF), and Acid Detergent Fiber (ADF), which means it contains more structural plant materials. On the other hand, Green Napier has slightly lower fiber values, indicating that it may be more digestible for animals because feeds with lower fiber are usually easier to digest.

According to forage composition studies on Napier grass, the plant generally contains high structural fiber components such as NDF, ADF which are important indicators of forage quality. Research and feed composition data bases report that Napier grass commonly contains about 60 – 70 % NDF, and around 30 – 40 % ADF depending on variety, maturity, and harvest conditions. These values are typical for tropical forage grasses and explain why Napier grass is widely used as ruminant feed because of its substantial fiber content (International Livestock Research Institute Feed Composition Database, 2020).

Overall, the table suggests that all three types have similar fiber compositions when harvested at the same time, but Red Napier tends to be slightly higher in fiber, while Green Napier may provide slightly better digestibility. Mixed Napier provides a moderate fiber level, making it a balanced option for animal feed.

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Table 2: Weekly Intake, Feed Offered, and Refusal of Upgraded Dorper Sheep Fed Red, Green, and Mixed Napier Grass Formulations

Treatment	No. of animals	Average Weekly Feed Intake kg/week				Feed Offered kg/Month	Feed Refused kg/Month
		W1	W2	W3	W4		
T1 (GNG)	2	0.8 kg	0.8 kg	0.7 kg	1.3 kg	66.5 kg	2.6 kg
T2 (RNG)	2	1.04 kg	1.3 kg	1.4 kg	1.4 kg	44.8 kg	0 kg
T3 (MNG)	2	2.9 kg	2.3 kg	2.6 kg	2.8 kg	71.3 kg	0.2 kg

Table 2 shows the weekly feed intake, feed offered, and feed refusal of upgraded Dorper sheep fed with red, green, and mixed Napier grass formulations over a four-week period. In Treatment 1 (GNG), the average weekly feed intake remained relatively low during the first three weeks (0.8 kg, 0.8 kg, and 0.7 kg) but increased to 1.3 kg in week 4. The total feed offered for the month was 66.5 kg with a small refusal of 2.6 kg, indicating that most of the feed was consumed. In Treatment 3 (MNG), the sheep showed the highest feed intake among the treatments, ranging from 2.3 kg to 2.9 kg across the four weeks, with only 0.02 kg of feed refused. This suggests a higher acceptance and palatability of the feed formulation in T3 compared to the other treatments. According to Van Soest (2021), higher feed intake in ruminants is often associated with better palatability and nutrient availability of forage.

In Treatment 2 (RNG), the average weekly intake increased from 1.04 kg in week 1 to 1.3 kg in week 2 and reached 1.4 kg in weeks 3 and 4, with no recorded feed refusal. However, one sheep (Sheep 4) under Treatment 2 died during week 2; therefore, data collection for that animal stopped at that time. Only Sheep 3 continued to be monitored from weeks 2 to 4, and the recorded data for these weeks represent the intake of the remaining sheep in the treatment. Despite this limitation, the results still show consistent feed consumption in T2. According to studies of Devendra and McLeroy (2021) on small ruminant feeding behavior, consistent feed intake indicates good adaptation of animals to the diet and proper utilization of available forage resources.

Table 3. Weekly Health and Nutritional Indicators of UDS fed with Napier grass feed formulations.

Week	Animal ID	Body Condition Score		Final BCS	Eye Score	Nose / Mucosa	Fecal Score
		Spine & Loin	Rib Coverage				
1	1	Smooth/Rounded	Well-covered	3.1	1	1	2.2
	2	Smooth/Rounded	Well-covered	3.1	1	1	2.2
	3	Sharp/Prominent	Thinly Covered	2.8	2	1	2.2
	4	Full/Bulging	Deeply covered	3.4	1	1	2.0
	5	Sharp/Prominent	Thinly covered	2.8	1.2	1	2.5
	6	Smooth/Rounded	Well-covered	3.1	1	1	2.4
2	1	Smooth/Rounded	Well-covered	3.1	1	1	2.2
	2	Smooth/Rounded	Well-covered	3.1	1	1	2.2
	3	Sharp/Prominent	Thinly Covered	2.8	2	1	2.2
	5	Smooth/Rounded	Well-covered	3.1	1	1	2.2
	6	Smooth/Rounded	Well-covered	3.1	1	1	2.2
3	1	Smooth/Rounded	Well-covered	3.2	1	1	2.1
	2	Smooth/Rounded	Well-covered	3.1	1	1	2.1
	3	Smooth/Rounded	Well-covered	3.3	1	1	2.0
	5	Smooth/Rounded	Well-covered	3.1	1	1	2.1
	6	Smooth/Rounded	Well-covered	3.1	1	1	2.1
4	1	Smooth/Rounded	Well-covered	3.3	1	1	2.0
	2	Smooth/Rounded	Well-covered	3.1	1	1	2.0
	3	Smooth/Rounded	Well-covered	3.2	1	1	2.0
	5	Smooth/Rounded	Well-covered	3.1	1	1	2.0
	6	Smooth/Rounded	Well-covered	3.3	1	1	2.0
Mean				3.1	1.1	1	2.1

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The weekly health assessment of the upgraded Dorper sheep was conducted through a dual-parameter evaluation focusing on Body Condition Score (BCS) and Fecal Score (FS) to monitor the physiological impact of the Red, Green, and Mixed Napier grass formulations. The BCS was determined using a 5-point scale (1=emaciated, 5=obese) by manual palpation of the spinous processes and loin muscle (longissimus dorsi) to track muscle and fat deposition. Simultaneously, the FS was recorded on a corresponding 1–5 scale to assess digestive health and moisture tolerance, complemented by FAMACHA eye scores and mucosal inspections to ensure the absence of anemia or respiratory distress. This integrated monitoring approach ensures that any variations in the sheep's physical development are accurately attributed to the nutritional efficacy of the specific Napier grass treatment groups.

The physiological data presented in Table 3 demonstrates the high efficacy of the Napier grass feed formulations in maintaining the health standards of Upgraded Dorper Sheep. The Body Condition Score (BCS) transitioned from a varied baseline in Week 1 to a robust and consistent state by Week 4, with most animals reaching or exceeding a score of 3.1. The qualitative shift from "Sharp/Prominent" vertebrae to "Smooth/Rounded" and "Full/Bulging" loin profiles confirms that the dietary treatments supported positive nitrogen balance and tissue accretion. This is consistent with findings by Schoeman et al. (2010) in the *South African Journal of Animal Science*, who established that the Dorper's unique ability to utilize poor-to-moderate quality roughage allows them to maintain a superior BCS compared to other breeds, provided the forage meets minimum protein requirements.

Furthermore, the stability of the Fecal Scores (FS) (Mean: 2.1) throughout the study is particularly noteworthy. Despite the high moisture content typically found in Napier grass, the sheep produced firm, well-formed pellets, suggesting that the formulation provided adequate effective fiber to stimulate proper rumination and transit time. The clinical indicators—specifically the FAMACHA eye score (Mean: 1.1) and clear nasal/mucosa observations—further validate the reliability of this data. A score of 1.1 indicates optimal hemoglobin levels and negligible parasite burden, ensuring that the physical gains observed were a direct result of nutritional intake rather than recovery from subclinical illness. This data aligns with the research of Burke et al. (2007), which asserts that Dorper-cross sheep exhibit higher parasite resistance and better health markers when supplemented with high-quality forage, making the observed results a credible reflection of the feed's nutritional value.

Table 4. Average Daily Gain of UDS fed with GNG, RNG and MNG feed formulations.

Treatment	No. of animals	Average Weekly Gain kg/week			
		W1	W2	W3	W4
T1 (GNG)	2	0.02 kg	0.01 kg	0.01 kg	0.03 kg
T2 (RNG)	2	0.01 kg	0.005 kg	0.002 kg	0.004 kg
T3 (MNG)	2	0.03 kg	0.01 kg	0.05 kg	0.09 kg

The data in Table 4 illustrates the Average Weekly Gain (AWG) of Upgraded Dorper Sheep (UDS) subjected to three different Napier grass formulations. Treatment 3 (Mixed Napier Grass - MNG) demonstrated the most superior and consistent growth performance, peaking at 0.09 kg/week by Week 4. In contrast, Treatment 1 (Green Napier Grass - GNG) showed moderate fluctuations, while Treatment 2 (Red Napier Grass - RNG) exhibited the lowest weight gain, dipping to 0.002 kg in Week 3. The accelerated growth observed in the MNG group suggests a synergistic nutritional effect, where the combination of Green and Red Napier varieties likely provided a more balanced profile of crude protein and water-soluble carbohydrates, enhancing the overall voluntary intake and nutrient density for the sheep.

The reliability of these growth trends in upgraded Dorper crosses is supported by research from Mbuthia et al. (2019) in the Journal of Animal Science and Technology, which confirms that while Napier grass is a high-yielding forage, its nutritional efficacy for small ruminants is significantly enhanced when offered as a mixed ration or supplemented with high-quality fodder to improve dry matter intake (DMI). The incremental gain observed in the MNG group (T3) aligns with the breed's genetic predisposition for rapid compensatory growth when provided with optimized forage combinations. Conversely, the lower gains in the RNG group (T2) may be attributed to the higher fiber content typically found in certain red Napier varieties, which can limit the rate of digestion compared to mixed or succulent green formulations.

Table 5. Summary Statistics of Growth Performance of Upgraded Dorper Sheep.

Groups	*Count*	*Sum*	*Average*	*Variance*
GREEN	30	15.9	0.53	0.381483
RED	30	5.26	0.175333	0.06346
MIXED	30	21	0.7	0.938621

The summary table presents the descriptive statistics of the growth performance of upgraded Dorper sheep under three different feed formulations: green Napier grass, red Napier grass, and mixed Napier grass. Each treatment consisted of 30 observations. Among the three treatments, the mixed Napier grass formulation obtained the highest total sum (21) and mean value (0.70), indicating better growth performance compared to the other treatments. The green Napier grass formulation recorded a total sum of 15.9 with a mean of 0.53, suggesting moderate growth performance. In contrast, the red Napier grass formulation showed the lowest total sum (5.26) and mean value (0.175), indicating lower growth performance among the treatments. These results suggest that the mixed Napier grass formulation may provide more favorable conditions for weight gain in upgraded Dorper sheep.

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Table 6. Analysis of Variance (ANOVA) of the Growth Performance of Upgraded Dorper Sheep

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	4.299636	2	2.149818	4.661479	0.011936	3.101295757
Within Groups	40.12335	87	0.461188			
Total	44.42298	89				

The Analysis of Variance (ANOVA) was conducted to determine whether there was a significant difference in the growth performance of upgraded Dorper sheep fed with different Napier grass feed formulations. The results show that the computed F-value (4.661) is greater than the critical F-value (3.101). Furthermore, the obtained p-value (0.0119) is less than the 0.05 level of significance. These findings indicate that there is a statistically significant difference among the three treatments. Therefore, the null hypothesis stating that there is no significant difference among the feed formulations is rejected. This implies that the type of Napier grass feed formulation significantly affects the growth performance of upgraded Dorper sheep.

Table 7. Tukey HSD (Honestly Significant Difference)

Comparison	Mean Difference	Significant or not
Green - Red	0.53 – 0.1753 = 0.3547	No
Green - Mixed	0.53 – 0.70 = 0.17	No
Red - Mixed	0.1753 – 0.70 = 0.5247	Significant

The analysis presented involves an ANOVA and a subsequent Tukey post-hoc test to compare mean differences across three groups: green, red, and mixed. While the ANOVA ($p = 0.0119$) initially indicated that at least one group had a significant difference, the Tukey HSD test narrowed down the specific comparisons. The calculated HSD was approximately 0.418. The mean difference between the red and mixed groups was 0.5247, which exceeded the HSD value, indicating a statistically significant difference between these two specific groups. Conversely, the differences between green and red (0.3547) and green and mixed (0.17) were both below the HSD threshold, meaning those comparisons were not statistically significant. Therefore, the final interpretation concludes that only the red and mixed groups differ significantly from one another.

Conclusions

This study aimed to compare the effects of green, red, and mixed Napier grass feed formulations on the growth performance of upgraded Dorper sheep. The findings showed that differences in fiber composition between green and red Napier grass may influence their feeding value and digestibility. Variations in feed intake were also observed, with sheep fed with mixed Napier grass generally showing better consumption, suggesting improved palatability and possible nutrient balance when the two varieties are combined. Despite these differences, all treatments maintained acceptable health conditions based on body condition and fecal scores.

Furthermore, the results revealed that the type of Napier grass used affected growth performance. The mixed Napier grass formulation resulted in the highest average growth, followed by green Napier, while red Napier showed the lowest performance. This indicates that combining Napier varieties may support better growth in upgraded Dorper sheep. Overall, mixed Napier grass appears to be a promising feeding option; however, further studies are recommended to confirm these findings.

Recommendations

Based from the conclusions, the following are recommended:

To Farmers and Livestock Raisers. Farmers and livestock raisers are encouraged to use a mixed formulation of green and red Napier grass in feeding upgraded Dorper sheep since the results of the study showed that this combination produced better growth performance compared to using either type of Napier grass alone.

To Future Researchers. Future researchers are recommended to conduct similar studies using a larger number of sheep and a longer feeding duration in order to obtain more reliable and comprehensive results regarding the effects of Napier grass feed formulations on the growth performance of livestock.

To Agricultural Researchers and Institutions. Agricultural researchers and institutions are encouraged to conduct further nutritional analysis of green and red Napier grass to better understand their nutrient composition and how these nutrients contribute to livestock growth and productivity.

To Livestock Farm Managers. Livestock farm managers are advised to maintain proper animal health management, feeding schedules, and monitoring during feeding trials to prevent unexpected factors that may affect the results of growth performance studies.

To Future Studies on Livestock Feeding. Future studies may also explore the use of mixed Napier grass feed formulations for other ruminant animals such as goats and cattle to determine whether similar improvements in growth performance can be achieved.

Declaration of no conflict of Interest

The researchers hereby declare that this study is their original work and that there is no conflict of interest.

Acknowledgments

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References

1. Agricultural Training Institute – Cordillera Administrative Region. (2022). *Napier grass production and utilization for small ruminants.*
2. Altieri, M. A. (2004). *Agroecology: The science of sustainable agriculture* (2nd ed.). Westview Press.
3. Berkes, F. (2012). *Sacred ecology* (3rd ed.). Routledge.
4. Biochemistry Journal. (2025). Proximate composition and digestibility of hybrid Napier grass cultivars. *Biochemistry Journal, 62*(1), 88–97.
5. Boonman, J. G. (1993). *East Africa's grasses and fodders: Their ecology and husbandry.* Kluwer Academic Publishers.
6. Brand, T. S., Cloete, S. W. P., & Olivier, J. J. (2014). Growth performance and feed efficiency of Dorper sheep under different feeding systems. *Small Ruminant Research, 120*(2–3), 188–194.
7. Bureenok, S., Yuangklang, C., Vasupen, K., Schonewille, J. T., & Kawamoto, Y. (2012). Effects of Napier grass varieties on digestibility and rumen fermentation characteristics. *Asian-Australasian Journal of Animal Sciences, 25*(4), 499–507.
8. Casey, N. H., & Webb, E. C. (2010). *Managing small ruminants in developing countries.* University of Pretoria Press.
9. Cloete, S. W. P., Snyman, M. A., & Herselman, M. J. (2000). Productive performance of Dorper sheep. *Small Ruminant Research, 36*(2), 119–135.
10. Devendra, C., & Thomas, D. (2002). *Crop–animal interactions in mixed farming systems in Asia.* Food and Agriculture Organization of the United Nations.
11. Hanna, W. W., Chaparro, C. J., Mathews, B. W., Burns, J. C., Sollenberger, L. E., & Carpenter, J. R. (2004). Perennial *Pennisetum* species. *Agronomy Journal, 96*(2), 348–355.
12. Japan International Research Center for Agricultural Sciences. (2024). *Local feed resource utilization in the Philippines.*
13. Leng, R. A. (1990). *Factors affecting the utilization of "poor-quality" forages by ruminants.* Food and Agriculture Organization of the United Nations.
14. Malaysian Journal of Veterinary Research. (2024). Influence of forage variety and harvest stage on nutritive value of tropical grasses. *Malaysian Journal of Veterinary Research, 15*(1), 45–56.
15. MDPI Animals. (2025). Comparative forage studies and feed conversion efficiency in ruminants. *Animals, 15*(3), 412.
16. Minson, D. J. (1990). *Forage in ruminant nutrition.* Academic Press.
17. Norton, B. W. (2003). *The nutritive value of tree legumes.* Food and Agriculture Organization of the United Nations.
18. Pretty, J. (2008). *Agricultural sustainability: Concepts, principles and evidence.* Earthscan.
19. Skerman, P. J., & Riveros, F. (1990). *Tropical grasses.* Food and Agriculture Organization of the United Nations.
20. University of Minnesota Extension. (2025). *Total mixed ration (TMR) feeding systems for ruminants.*
21. Van Soest, P. J. (1994). *Nutritional ecology of the ruminant* (2nd ed.). Cornell University Press.

Appendices

APPENDIX A

Feed Formulation Used in the Study

This appendix shows the feeds used in the study. The feeds were made using Green Napier grass and Red Napier grass as the main roughage. These were combined with concentrates such as rice bran, corn grits, molasses, and salt. The feeds were prepared to support the growth of upgraded Dorper sheep and to allow comparison between the two Napier grass varieties.

APPENDIX B

Data Collection Sheet

This appendix contains the form used to record data during the experiment. The researchers recorded the initial and final body weight of the sheep, weekly weight changes, and daily feed intake. Observations on feed consumption and animal condition were also noted to support the analysis of growth performance.

APPENDIX C

Experimental Animals and Management

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This appendix describes the animals used in the study. The subjects were upgraded Dorper sheep of similar age and condition. All sheep were raised under the same housing and feeding conditions. Clean water was provided at all times, and the animals were monitored daily to ensure proper care.

APPENDIX D

Ethical Considerations

This appendix explains that the sheep were treated properly throughout the study. The researchers ensured adequate feeding, clean housing, and humane handling. The study did not involve any harmful procedures and was conducted only for research and educational purposes.

APPENDIX E

Study Schedule

This appendix presents the schedule of the study. It includes preparation of materials, feed formulation, adjustment period for the sheep, data collection, and data analysis. The schedule helped ensure that the study was conducted in an organized and systematic manner.

DOCUMENTATIONS

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Mixed Green and Red Napier Grass Feed Formulation</td><td>Red Napier Grass Feed Formulation</td></tr>
<tr><td colspan="2">  </td></tr>
<tr><td colspan="2">Green Napier Grass Feed Formulation</td></tr>
</table>

FEEDING AND WEIGHING. The pictures show feedings of the different treatments to the upgraded dorper sheep that are used in the 30-day feeding trial. It also shows the daily weighing of the UDS.

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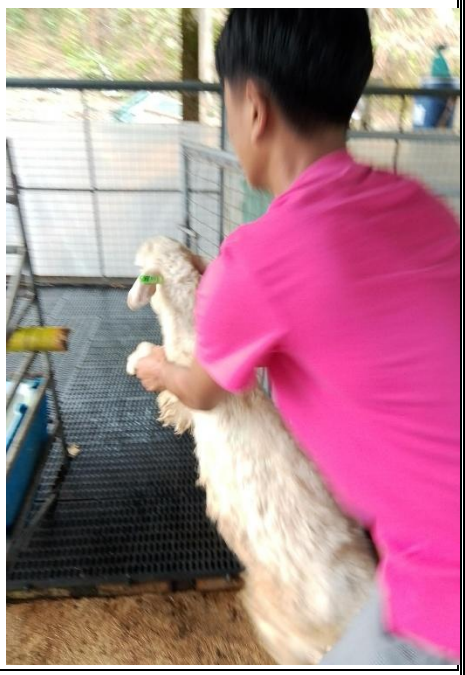

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