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# Impact of Fertilization on Productivity and Nutritional Quality of Napier Varieties in Southern Mindanao, Philippines

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

**Aims:** This study investigates the effects of fertilizer application on the growth performance, proximate composition, and chlorophyll content of three Napier grass varieties (King, Pakchong, and Juncao) in Southern Mindanao, Philippines.
**Study Design:** Utilizing a Randomized Complete Block Design with a 3x2 factorial arrangement.
**Place and Duration of Study:** The experiment was performed at the University of Southern Mindanao Animal Production Center facilities from January to March 2023.

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**Methodology:** The three Napier grass varieties (King, Pakchong, and Juncao) was the first factor, and fertilizer application (with or without) were the second factor. Four blocks were prepared, each containing six plots, resulting in 24 plots. The fertilized plots received two applications of 150kg N/ha and 75kg N/ha of the recommended NPK fertilizer, respectively, while non-fertilized plots did not receive any fertilizer.
**Results:** Results showed that fertilizer application significantly improved herbage yield, with fertilized plants yielding 20.25 tons per hectare compared to 15.14 tons in non-fertilized plants. Pakchong exhibited the highest yield and crude fiber content, while Juncao grass showed higher crude protein content without fertilizer. Fertilization also increased ether extract content, with Pakchong displaying the greatest response. However, nitrogen-free extract (NFE) was higher in non-fertilized plants across all varieties, indicating a complex interaction between nutrient availability and carbohydrate allocation.
**Conclusion:** These findings underscore the importance of targeted fertilizer management to optimize both growth and nutritional quality, depending on specific production goals. The differential responses among Napier varieties suggest the potential for variety-specific fertilization strategies, which can enhance forage quality and sustainability in livestock farming. Further research is recommended to explore the long-term impacts of continuous fertilization and the underlying genetic mechanisms driving varietal differences.

*Keywords: Napier grass; dilution effect; proximate composition; growth performance; chlorophyll content; forage productivity.*

## 1. INTRODUCTION

Napier grass, also called Uganda grass or elephant grass (*Pennisetum purpureum*), is a tall, vigorous, and deep-rooted perennial tropical forage known for its rapid growth, high biomass yield, and nutritional value. Stems can reach up to 7 meters in height, 3 cm in diameter, and have up to 20 nodes. Napier grass thrives in warm tropical and subtropical environments, performing exceptionally well at 25-40°C [1]. Genetic studies have revealed significant diversity among Napier grass genotypes, aiding breeding strategies and conservation efforts [2,3]. Napier grass, widely cultivated in developing countries, is valuable for animal feed and has potential as an energy crop [4].

The performance of Napier grass under various fertilization regimes has shown significant effects on growth, yield, and economic returns. Veraque and Gorne [5] evaluated different nitrogen levels in Leyte, Philippines, revealing that Napier grass achieved optimal growth and yield at 120 kg N/ha, with the highest economic return observed at 240 kg N/ha. Ebrahim et al. [6] studied nitrogen rates and cutting heights in Ethiopia, finding that nitrogen application at 161 kg/ha and a cutting height of 15 cm maximized dry matter yield and crude protein content. However, nitrogen recovery was most efficient at a lower 69 kg/ha application rate. Tesfaye et al. [7] highlighted the interaction between cutting height and fertilizer, noting that the highest dry matter yield was achieved with a 1.0 m cutting height and 92 kg N/ha. Bandeswaran et al. [8] demonstrated that combining organic manures with inorganic nitrogen significantly boosted biomass yield and crude protein content, particularly with the highest nitrogen level (60 kg/acre). Fernando et al. [9] focused on Red Napier in Sri Lanka, showing that poultry manure led to superior dry matter and crude fiber content compared to other treatments.

Meanwhile, the performance of Napier grass (*Pennisetum purpureum*) varies across climatic and environmental conditions. Kebede et al. [10] found the highest dry matter (DM) yield in mid-altitude areas of Ethiopia, while crude protein (CP) and digestibility were higher in the highlands. Geren et al. [11] recommended a 60-day cutting interval for optimal forage yield and quality in Mediterranean regions with irrigation. Tsegaye et al. [12] reported that Napier grass produced the highest forage yield among three grasses in Ethiopia, with increased DM yield but decreased CP at 120-day cutting. Biradar et al. [13] observed that the hybrid cultivar DHN-15 had significantly higher green fodder yield and net returns under irrigated conditions in India.

The response of Napier grass to fertilizers is well-documented, particularly its high demand for nutrients and its positive reaction to both organic and inorganic (NPK) fertilizers, as well as seasonal climatic variations that also significantly affect the total dry matter yield and quality of Napier grass. However, the interaction between different Napier grass cultivars and fertilizer application under specific local conditions still needs to be explored. This study addresses this gap by investigating the effects of fertilizer application on the growth performance, proximate composition, and chlorophyll content of three Napier grass varieties (King, Pakchong, and Juncao) in Southern Mindanao, Philippines. Unlike previous studies, which have typically focused on a single variety or generalized responses to fertilization, this research provides a comparative analysis of multiple cultivars under uniform environmental conditions. This approach identifies cultivar-specific responses to fertilizer application, contributing to more tailored management strategies that optimize productivity and forage quality. We hypothesize that fertilizer application will significantly influence the physical characteristics, nutritional profile, and chlorophyll content of the Napier grass varieties, with potential variations in response among the cultivars. The specific objectives are to evaluate the impact of fertilizer on growth performance, assess its effects on proximate composition, and determine its influence on the chlorophyll content of the three Napier grass varieties.

## 2. MATERIALS AND METHODS

### 2.1 Study location

The experiment was performed at the University of Southern Mindanao Animal Production Center facilities from January to March 2023. The center was located at Kabacan, North Cotabato, Southern Mindanao, at 7.1071923 latitude, 124.8403408 longitude, and 31.75 meters above sea level, in a tropical rainforest climate (Classification: Af). The district's mean annual temperature is 28. 62ºC, 178. Eighty-eight millimeters of precipitation and 242.57 rainy days (66.46% of the time) annually (Weather and Climate, 2023).

### 2.2 Research Design and Treatment

The experiment employed a Randomized Complete Block Design (RCBD) with a 3x2 factorial arrangement. The first factor consisted of three Napier grass varieties (King, Pakchong, and Juncao), and the second factor was fertilizer application (with or without). Four blocks were prepared, each containing six plots, resulting in 24 plots. Based on soil test results, fertilized plots received two applications of 150kg N/ha and 75kg N/ha of the recommended fertilizer, respectively, while non-fertilized plots did not receive any fertilizer.

### 2.3 Napier Planting and Treatment Application

Healthy Napier grass stems with 2-3 nodes were selected as planting materials from the University Forage area. The stems were planted at a 45-degree angle in furrows, with two cuttings per hill and a spacing of 1 m x 1 m. The plots were prepared by plowing and harrowing twice to achieve a friable soil texture and eliminate weeds. Following soil test recommendations, fertilizer was applied twice, 30 and 45 days after planting. Weeding was done manually at 2 and 4 weeks after emergence to prevent competition. Before planting, soil samples from the 0-30 cm layer were collected using a soil auger following the procedures by Adajar & Taer [14] and analyzed for NPK, pH, and organic matter content at the Department of Agriculture Regional Soils Laboratory. At 60 days after planting, the Napier grasses were harvested by cutting 6 inches from the ground. The fresh weight of the harvested grass was recorded, and 1 kg of samples were dried at 65°C for 72 hours for proximate analysis. Tiller counts were taken from randomly selected plants per plot before harvesting.

### 2.4 Data Collection

**Plant height:** Measured from the ground to the highest point of the plant.

**Stem diameter:** Measured at the base of 10 representative plants.

**Leaf width:** Measured at the broadest part of a representative leaf from 10 plants.

**Number of tillers:** Counted for ten representative plants per plot.

**Herbage yield:** Total fresh forage harvested from each plot, with dry matter content calculated by oven-drying samples to a constant weight.

**Chlorophyll content:** Measured using a Greenseeker Handheld Crop Sensor.

**Proximate analysis:** Conducted on triplicate 250-300 g samples from each treatment, analyzed at the DA Region XI Feed Analytical Laboratory for moisture, crude protein, crude fiber, ash, nitrogen-free extract (NFE), and ether extract content.

### 2.5 Statistical Analysis

The data obtained from the experiment were analyzed using the Statistical Tool for Agricultural Research (STAR), which is specifically designed for comprehensive data analysis in agricultural research. A two-way analysis of variance (ANOVA) was employed to assess the effects of fertilizer application and Napier grass varieties.

## 3. RESULTS AND DISCUSSION

### 3.1 Soil Test Results, Recommendations and Climatic Data

Soil test results indicated a moderately acidic pH of 6.00, moderate organic matter (OM) content at 3.29%, higher phosphorus (P) levels measuring at 41.95 ppm, while very high potassium (K) levels notably at 1337.01 ppm. Given the nutrient requirements 60-0-0, fertilizer recommendations are derived from the soil test outcomes. According to the tests and recommendations, the fertilizer used was Ammosol at 1. 5 – 3 bags/ha for the first application and UREA at a rate of 0. 75 – 1. 25 bags/ha for the second application. The temperature, relative humidity, and rainfall for January 2023 to March 2023 were calculated as 32. 51ºC, 76. 49 %, 101. 02 mm.

### 3.2 Growth Performance

Fertilized plants exhibited significantly greater plant height, improved stem diameter, and higher leaf width and tiller number compared to non-fertilized plants. Fertilized plants reached an average height of 107.17 cm, in contrast to the 76.32 cm recorded in non-fertilized plants. The Pakchong hybrid displayed the largest stem width (22.60 cm), followed closely by King and Juncao (22.20 cm and 22.10 cm, respectively). Pakchong and Juncao hybrids also had broader leaves (3.85 cm and 3.74 cm, respectively) compared to King Napier grass (3.53 cm). Tiller numbers were significantly higher in fertilized Napiers, ranging from 26.96 to 29.70, compared to 16.89 to 18.75 in non-fertilized Napiers. The increased growth metrics in fertilized plants emphasize the critical role of nitrogen in enhancing Napier grass performance. Nitrogen is essential for synthesizing amino acids, enzymes, and proteins, driving vertical growth and vascular development. This is consistent with the findings of Gioseffi et al. [15] and Tatsumi et al. [16], who also reported increased plant height and stem diameter with nitrogen supplementation. The broader leaves observed in the Pakchong and Juncao hybrids is linked to their hybrid vigor, which confers traits such as drought tolerance and adaptability from pearl millet [17,18]. Additionally, higher tiller numbers in fertilized plants are likely due to nitrogen's influence on cytokinin activity, promoting cell division and enlargement [19]. The observed improvement in plant height, stem diameter, leaf width, and tiller number align with previous studies that highlight nitrogen's role in promoting biomass accumulation. This clear distinction in growth performance suggests that targeted fertilizer application can significantly enhance Napier grass productivity. The differential responses among varieties indicate the potential for optimizing specific cultivars for maximum growth and yield tailored to their genetic and physiological characteristics. Future research should focus on the long-term impacts of continuous fertilization and explore the genetic mechanisms that underpin these responses.

**Table 1. Growth performance of Napier grass varieties with and without fertilizer application**

| Parameter | | Plant height (cm) | Stem diameter (cm) | Leaf width (cm) | No. of tillers |
|---|---|---|---|---|---|
| Fertilizer application | With | 107.17$^a$ | 5.58$^a$ | 3.85$^a$ | 34.11$^a$ |
| | Without | 76.32$^b$ | 5.38$^b$ | 3.55$^b$ | 21.64$^b$ |
| Varieties of Napier | Kind grass | 86.13 | 5.45 | 3.53$^b$ | 26.96 |
| | Pakchong | 98.55 | 5.50 | 3.85$^a$ | 29.7 |
| | Juncao | 90.55 | 5.50 | 3.74$^a$ | 26.98 |
| P-Value | Fertilizer | 0.000** | 0.000** | 0.0023** | 0.00** |
| | Variety | 0.1308 | 0.4134 | 0.0198* | 0.154 |
| | Fertilizer x Variety | 0.0943 | 0.0918 | 0.2451 | 0.108 |
| CV | | 12.7 | 1.54 | 5.55 | 10.99 |

*Column means with the same letter are not significantly different at 0.05 level*
***Highly significant*

**Table 2. Yield characteristics and chlorophyll content of napier grass varieties with and without fertilizer application**

| Parameter | | Yield (tons/ha/year) | Chlorophyll content |
|---|---|---|---|
| Fertilizer application | With | 20.25[a] | 0.57[a] |
| | Without | 15.14[b] | 0.52[b] |
| Varieties of Napier | Kind grass | 16.75 | 0.56[a] |
| | Pakchong | 19.25 | 0.51[b] |
| | Juncao | 17.50 | 0.57[a] |
| P-Value | Fertilizer | 0.001** | 0.0016** |
| | Variety | 0.249 | 0.0077** |
| | Fertilizer x Variety | 0.98 | 0.805 |
| CV | | 16.48 | 6.57 |

*Column means with the same letter are not significantly different at 0.05 level*
***Highly significant*

### 3.3 Yield and Chlorophyll Content

Fertilizer application significantly increased herbage yield, with fertilized plants producing an average of 20.25 tons per hectare compared to 15.14 tons per hectare in non-fertilized plants. Among the varieties, Pakchong exhibited the highest yield (19.25 tons), followed by Juncao (17.50 tons) and King grass (16.75 tons). Chlorophyll content was also higher in fertilized plants (0.57) compared to non-fertilized plants (0.52). King grass and Juncao hybrid Napier grass had higher chlorophyll content (0.56 and 0.57, respectively) compared to Pakchong (0.51). However, no significant interaction between variety and fertilizer application was observed for yield. The observed increase in herbage yield with fertilizer application underscores nitrogen's essential role in plant growth, particularly in protein synthesis and photosynthesis [20]. These results align with Veraque and Gorne [5], who found that increasing nitrogen levels significantly improved Napier grass yield, with optimal growth at 120 kg N/ha. Pakchong's superior yield performance highlights its genetic potential for robust growth under fertilized conditions [21,22]. The higher chlorophyll content in fertilized plants, particularly in King and Juncao varieties, reflects enhanced photosynthetic efficiency due to improved nitrogen availability, which is crucial for chlorophyll synthesis [23]. The variation in chlorophyll content among the varieties are attributed to genetic differences in nutrient uptake and utilization efficiency [24]. The lack of significant interaction between fertilizer and variety for yield suggests that fertilization consistently boosts productivity across different genetic backgrounds [25]. These findings emphasize the universal benefit of nitrogen fertilization for increasing Napier grass productivity, though the degree of response vary among varieties. Future research should investigate the genetic mechanisms behind these differential responses and optimize fertilizer management for each variety [26].

### 3.4 The Moisture Content of Napier

King Grass exhibited a significant response to fertilizer application, with an increase of 1.72% in moisture content. In contrast, the Pakchong and Juncao varieties showed a decrease in moisture content under the same fertilized conditions. Overall, applying fertilizer increased the moisture level of all grass varieties from 11.25% to 11.79%. Interestingly, the highest moisture content was observed in fertilized Juncao Grass and unfertilized King Grass, suggesting potential intrinsic differences in water retention or varied responses to fertilizer regarding water usage among the Napier grass varieties.Moisture content in King Grass following fertilizer application could be linked to enhanced water uptake and retention capabilities due to improved root development and overall plant health. The differential responses observed among the varieties suggest that genetic factors are crucial in how each variety manages water under fertilized conditions. When fertilized, the decrease in moisture content in Pakchong and Juncao varieties could indicate a trade-off between rapid biomass accumulation and water retention capabilities. The overall increase in moisture content with fertilizer application aligns with previous studies that have shown nutrient supplementation can enhance the water-holding capacity of plants [27,28]. However, the fact that the observed differences did not reach statistical significance suggests that these effects might not be robust or consistently reproducible under similar conditions. This highlights the need for further research to clarify the precise mechanisms by which fertilizer affects water content in different Napier grass varieties and to determine the consistency of these responses under varying environmental conditions. This understanding could help optimize fertilizer application strategies to balance growth and moisture retention, thereby improving Napier grass's overall resilience and productivity.

### 3.5 Crude Protein

Fertilizer application generally increased crude protein content in King and Pakchong varieties. King Grass showed a significant reduction in crude protein when fertilizer was withheld, dropping from 14.05% to 11.68%. Similarly, Pakchong Grass exhibited a decrease in crude protein from 14.89% to 11.03% without fertilization. Interestingly, Juncao Grass demonstrated a unique response by maintaining higher crude protein content without fertilizer, increasing from 12.57% to 13.22% under non-fertilized conditions, suggesting a significant interaction between fertilizer application and Napier varieties (Table 3). The ability of Juncao Grass to maintain higher crude protein levels without fertilizer could be attributed to genetic differences in nutrient uptake and utilization or specific interactions between the variety and the applied fertilizer. This observation aligns with the findings by Lu & Tian [21] and Tokpa et al. [22], who noted that some cultivars can sustain or improve their nutritional quality in suboptimal nutrient environments due to unique physiological adaptations. In contrast, King and Pakchong grasses depend more heavily on external nitrogen sources to achieve optimal protein content, highlighting varietal differences in nutrient dependency. The role of nitrogen in promoting amino acid and protein synthesis is well-documented, with numerous studies corroborating the increase in crude protein content following fertilizer application in forage crops [20,29]. However, Juncao's response, maintaining higher protein levels without fertilization, suggests that genetic regulation, environmental conditions, and variety-specific nutrient interactions play a crucial role in determining protein levels [30,31]. Climatic factors have also influenced these outcomes. The study period's high temperatures (32.51°C), relative humidity (76.49%), and rainfall patterns could have interacted with the genetic traits of Juncao Grass, enhancing its ability to uptake and metabolize nutrients under non-fertilized conditions. Studies by Oliveira et al. [32] have shown that environmental conditions, particularly temperature and humidity, can affect nutrient uptake and metabolism across different plant varieties. This explains why Juncao Grass maintained higher protein levels without additional nitrogen, unlike King and Pakchong varieties. Further research is needed to explore the interaction between environmental factors and genetic traits in optimizing fertilization strategies for Napier varieties. Studies by Janket et al. [33] indicate that climatic variables, such as humidity, can impact nutrient uptake in other crops, such as tomatoes and cucumbers, which provide insights into similar mechanisms in Napier grass. Understanding these dynamics will help develop targeted fertilization strategies that optimize protein content under varying environmental conditions.

### 3.6 Crude Fiber

Pakchong Grass exhibited the highest crude fiber content (29.95%), which was significantly greater than King Grass (29.40%) and Juncao Grass (29.15%). Fertilizer application had a notable effect on crude fiber content, with the fertilized group showing a reduction (29.05%) compared to the non-fertilized group (29.95%). The higher crude fiber content observed in Pakchong aligns with findings from previous studies on fodder crops' nutritional profiles [34]. The decrease in crude fiber due to fertilization can be attributed to the "dilution effect," a rapid biomass accumulation leads to a relative reduction in the proportion of structural components like cellulose, hemicellulose, and lignin [35,23]. As nitrogen stimulates overall growth, the proportion of indigestible fiber components decreases, enhancing the digestibility of the forage and improving its nutritional value for livestock. Nitrogen's role in enzyme activity, particularly those involved in lignin synthesis—a key structural component of fiber— further explain the reduction in crude fiber with fertilization [36,37]. While fertilization promotes overall plant growth, it simultaneously alters the fiber composition, which influence both the structural integrity and nutritional quality of the forage. The decrease in crude fiber suggests a favorable trade-off, where greater biomass is coupled with enhanced forage quality due to lower levels of indigestible components.

### 3.7 Ash Content

There were no significant differences in ash content among varieties, with an average of 13.63% to 14.67%. The fertilized group showed an average ash content of 13.92% compared to 14.21% in the non-fertilized group, showing a trend of reduced ash content with fertilization but no statistical significance overall. The ash content, representing the mineral content of the Napier grass, did not significantly vary with fertilizer application. The trend of lower ash content in the fertilized group could be due to the "dilution effect," where the increase in overall plant biomass with fertilization results in a lower concentration of minerals per unit of biomass [25, 24]. This is consistent with findings in other crops where fertilization leads to increased growth but relatively lower mineral concentration, as seen in studies on maize and onion [26]. The consistently lower ash content in Pakchong Grass suggests inherent genetic differences in mineral uptake or utilization among the varieties. However, the lack of significant differences implies that the relative mineral composition remained largely stable across the different varieties and treatment conditions, highlighting the inherent mineral properties of each variety.

### 3.8 Ether Extract

Among the Napier grass varieties, Pakchong Grass showed the highest increase in ether extract (crude fat) content, rising from 0.73% without fertilizer to 0.92% with fertilizer, a 0.19% increase. In contrast, Juncao Grass exhibited the smallest increase, from 0.78% to 0.83%. Overall, fertilizer application increased the ether extract content across all three varieties. The observed rise in ether extract content suggests that fertilization enhances the crude fat content of Napier grass forage. This is particularly evident in Pakchong Grass, where the increase aligns with findings by Zapletalová et al. [38] and Ogunyemi et al. [39], who reported that certain nutrients in fertilizers can stimulate fatty acid synthesis in plant tissues. This increase in crude fat content boosts the energy value of the forage, improving its quality for animal feed. However, the relationship between fertilization and increased crude fat content is sometimes linear. Various factors, such as the specific nutrients supplied by the fertilizer and environmental conditions, can influence fatty acid synthesis differently. This variability suggests that while fertilization can enhance crude fat content, its effects are more complex and less predictable than on other nutritional components, like protein [38].

### 3.9 Nitrogen-free Extract

The data revealed that Pakchong Grass had the highest NFE content, significantly greater than that of Juncao and King Grass. Interestingly, NFE values were higher in non-fertilized plants across all varieties. Specifically, non-fertilized Pakchong Grass exhibited notably higher NFE content than its fertilized counterpart, indicating that a larger proportion of digestible carbohydrates was present in the non-fertilized group. Typically, fertilization promotes overall plant growth and biomass, but lead to a "dilution effect," where the proportion of digestible carbohydrates (NFE) decreases relative to total biomass [35; 25]. This reduction occurs as plants allocate more resources to structural components, such as cellulose and lignin, which are less digestible than carbohydrates [24,23]. Consequently, while fertilization enhances biomass production, it reduces the relative concentration of nitrogen-free extracts, potentially impacting the forage's energy value.

**Table 3. Proximate composition of Napier grass varieties with and without fertilizer application**

| Parameter | | Moisture | Crude protein | Crude fiber | Ash | NFE | Ether extract |
|---|---|---|---|---|---|---|---|
| Fertilizer application | With | 11.79 | 13.83 | 29.05$^{b}$ | 13.63 | 30.86 | 0.83 |
| | Without | 11.25 | 11.98 | 29.95$^{a}$ | 14.67 | 31.65 | 0.56 |
| Varieties of Napier | Kind grass | 11.64 | 12.87 | 29.40$^{b}$ | 15.49 | 29.93 $^{c}$ | 0.67 |
| | Pakchong | 11.08 | 12.96 | 29.95$^{a}$ | 11.98 | 33.20 $^{a}$ | 0.83 |
| | Juncao | 11.84 | 12.9 | 29.15$^{b}$ | 14.68 | 30.63 $^{b}$ | 0.81 |
| P-Value | Fertilizer | 0.072 | 0.423 | 0.021* | 0.402 | 0.55 | 0.22 |
| | Variety | 0.809 | 0.215 | 0.015* | 0.065 | 0.035* | 0.62 |
| | Fertilizer x Variety | 0.904 | 0.043* | 0.673 | 0.132 | 0.645 | 0.865 |
| CV | | 3.91 | 3.32 | 1.00 | 14.91 | 6.26 | 3.93 |

*Column means with the same letter are not significantly different at 0.05 level*
**Significant*

The unexpected increase in NFE under non-fertilized conditions also aligns with findings in other studies [25,23] highlight the importance of tailoring fertilization strategies to balance biomass production and the concentration of digestible carbohydrates, depending on specific production goals [40,41].

## 4. CONCLUSION

This study investigated the effects of fertilizer application on growth performance, proximate composition, and chlorophyll content of three Napier grass varieties (King, Pakchong, and Juncao) under Southern Mindanao conditions. Key findings revealed that fertilizer generally enhanced crude protein in King and Pakchong, but Juncao exhibited higher protein without fertilizer. Crude fiber decreased with fertilization, indicating a "dilution effect" favoring digestible components. Ether extract increased across varieties with fertilizer application. Surprisingly, Nitrogen-Free Extract (NFE) was higher without fertilizer, potentially due to plant stress responses. Regarding growth, fertilizer significantly improved plant height, stem diameter, leaf width, and tiller number, with no varietal differences. Herbage yield increased with fertilization, while King and Juncao had higher chlorophyll content than Pakchong. These results indicate that fertilization impacts proximate composition, growth, yield, and chlorophyll across Napier cultivars. However, Juncao's contrasting crude protein and NFE responses suggest complex interactions between genetics, physiology, and fertilizer effects. Understanding these nuances is crucial for optimizing productivity and quality under local conditions. Further research should explore the underlying mechanisms driving varietal differences and the long-term sustainability of fertilizer regimes on Napier grass production systems.

## DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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