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# Evaluation of Adaptation, Biomass Production, and Nutritive Value of Napier Grass Across Different Agro-Ecologies in the Somali Regional State, Ethiopia

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## ABSTRACT

A study was conducted to evaluate the agronomic performance and nutritional quality of three Napier grass (*Pennisetum purpureum*) varieties, 16819, 16984, & 16791, under irrigated conditions at Fafan, Dolo Ado, and Godey agricultural research centers in the Somali Regional State, Ethiopia. The experiment followed a randomized complete block design (RCBD) with three replications, considering variety and location as factors. Data on growth, yield, and nutritive value were analyzed using ANOVA through the General Linear Model (GLM) procedure in SAS (2009). Results showed highly significant (P<0.001) effects of variety, location, and their interaction on plant height, tiller number, internode length, and dry matter yield. Variety 16791 produced the tallest plants (215.9 cm) and the highest dry matter yield (23.9 t/ha), followed by 16984 (17.9 t/ha), while 16819 had the shortest plants (163.1 cm) and the lowest yield (14.6 t/ha). The highest number of tillers was observed in 16984 (16.46), with 16819 showing the fewest (14.54). Internode length ranged from 14.7 to 16.5 cm, with 16791 exhibiting the longest and 16984 the shortest. Nutritionally, 16791 had the highest dry matter content (93.06%) and crude protein (10.1%), along with the lowest acid detergent fiber (ADF) at 47.6%. In contrast, 16819 recorded the highest ash content (19.5%) and lowest dry matter (91.8%), while 16984 had the highest neutral detergent fiber (NDF) at 86.6% but the lowest crude protein (7.3%). Overall, varieties 16791 and 16984 showed superior performance in yield and nutritional quality. Variety 16791 is recommended for Fafan and similar agro-ecologies, while 16984 is better adapted to Godey and Dolo Ado conditions. Further research is needed to assess the chemical composition in detail, evaluate animal response, and study seasonal performance to ensure long-term adaptability and productivity.

## INTRODUCTION

Livestock production is a cornerstone of mixed crop-livestock systems in Ethiopia's highlands, significantly contributing to rural livelihoods by providing draft power, nutrition, income, and socio-economic security. In many rural communities, livestock also function as a form of "mobile bank," used for labor, inheritance, and household financial management (Amede *et al.,* 2005; Endalew & Ayalew, 2016). Despite its importance, the sector remains underproductive, largely due to inadequate quantity and quality of livestock feed (CSA, 2021).

To overcome feed shortages, the use of high-yielding and nutritious forage species has been widely recommended. Napier grass (*Pennisetum purpureum*), often referred to as the "king of grasses," is one such species. Known for its high palatability, biomass yield, and adaptability, it is favored by both cattle and sheep (Leta *et al.,* 2013). In the Ethiopian highlands, Napier grass plays a dual role in fodder supply and soil conservation and is commonly grown by smallholders using a cut-and-carry system to prevent overgrazing (Danano, 2007; Tessema & Alemayehu, 2010).

A perennial species belonging to the Poaceae family, Napier grass is believed to have originated in Southern Ethiopia, including areas like the Chencha district (Welle *et al.,* 2006). It thrives across a range of ecological zones and is known for rapid regrowth, allowing frequent harvests, especially during the rainy season, with potential for preservation such as hay or silage. Despite its popularity, limited agronomic and adaptive evaluation has been conducted across Ethiopia's diverse agro-ecological zones. The Ethiopian Ministry of Agriculture and Rural Development has promoted Napier grass as a land management tool for combating degradation (Zemene *et al.,* 2020). Yet, systematic efforts to collect, conserve, and characterize local forage species, including Napier grass, remain minimal, hindering sustainable livestock development. Feed scarcity, particularly in the dry season, continues to limit productivity (Mengistu *et al.,* 2021). Enhancing feed supply and quality through improved forage production is essential for sustainable livestock growth (Shapiro, 2017). Beyond improving animal nutrition, quality forages contribute to environmental sustainability by reducing greenhouse gas emissions, enhancing soil health, and supporting integrated crop–livestock systems (Eshetu & Teklu, 2015). Identifying and promoting superior forage cultivars is thus vital to achieving both feed security and ecosystem resilience (Fekede *et al.,* 2018).

Napier grass is especially valued for its rapid growth

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and high biomass potential under favorable conditions. Under optimal fertilization, yields can range from 20 to 120 t DM/ha/year, although typical on-farm yields are closer to 16 t DM/ha/year. In low-input systems, yields drop significantly, ranging from 2–10 t DM/ha/year (Muhammad, 2016).

In the Somali Region of Ethiopia, which is predominantly lowland and characterized by pastoral and agro-pastoral production systems, livestock, especially dairy and beef, are the primary livelihood source. However, milk supply is highly seasonal, and market prices fluctuate due to the unreliable availability of quality forage. Natural pastures are scarce, especially in dry periods, and integration of crops and livestock remains limited. Despite the presence of perennial rivers that offer potential for irrigated forage cultivation, no systematic studies have documented the performance or adaptability of Napier grass in the Somali Region. This presents a unique opportunity to explore its role in supporting year-round livestock feeding. Therefore, this study was initiated to evaluate the adaptability, agronomic performance, and nutritional value of selected Napier grass lines under irrigation across different agro-ecologies in the Somali Region. The findings aim to inform future interventions in forage development, address dry-season feed shortages, and enhance livestock productivity in pastoral and agro-pastoral systems.

## MATERIALS AND METHODS

### Description of the Study Area

The study station located at Fafan, Dollo Ado, and Godey which are located in different parts of the Somali Region of Ethiopia, each with distinct geographical and climatic conditions. Fafan Zone, located in the northern part of the region near the border with Somaliland, lies approximately at 9.35° N latitude and 42.80° E longitude. Due to its higher elevation, Fafan enjoys a moderate semi-arid climate, with temperatures ranging from 20°C to 30°C, and receives relatively better annual rainfall of about 500–700 mm. Its clay and loam soils are more fertile compared to the rest of the Somali Region, making it suitable for agro-pastoral livelihoods. In contrast, Dollo Ado, situated in the southernmost part of the Somali Region near the Kenya and Somalia borders at around 4.18° N, 42.08° E, experiences a hot arid climate with temperatures often reaching 38°C. Rainfall is low and unreliable, averaging 300–500 mm annually, and the soil is predominantly sandy and less fertile, supporting primarily pastoralism. Godey, located in the central-eastern part of the region along the Shebelle River at approximately 5.05° N, 43.59° E, has a hot semi-arid climate with temperatures between 26°C and 36°C and annual rainfall of about 400–600 mm. Its alluvial soil near the river is relatively fertile, supporting some irrigated agriculture, though sandy soils dominate the surrounding drylands. These variations in temperature, rainfall, and soil quality influence the livelihood patterns and agricultural potential across the three zones.

### Experimental Layout, Design, and Treatments

Three released Napier grass varieties (ILRI-16819, ILRI-16984, and ILRI-16791) were utilized in this study. Planting materials were obtained from the Debre Zeit Agricultural Research Center and established under varying agro-ecological conditions to assess their agronomic performance. The evaluation was conducted at Fafan, Dollo Ado, and Godey Agricultural Research Centers during the 2022/2023 main cropping season under irrigated conditions. The experimental design followed a randomized complete block design (RCBD) with three replications. Each variety was randomly allocated to plots within each block. Plots measured 12 m² (4 m × 3 m), with root splits planted in four rows per plot, using inter-row and intra-row spacings of 100 cm and 50 cm, respectively. Blocks were separated by 2 m alleyways, and individual plots were spaced 1 m apart.

### Data Collection Procedure

Agronomic performance data were collected throughout the growing season. The agronomic data collected includes, number of tillers per plant, plant height, forage DM yield, leaf to stem ratio, number of nodes per plant and inter node length per plant. Plant height was measured at each harvest by measuring the distance from the ground to the tip of the main stem of 10 randomly selected plants per plot, using a measuring tape (cm). The number of tillers per plant was also recorded at each harvest by counting the tillers on 10 randomly selected plants from each plot.

To assess biomass production, the total forage yield was harvested from the central rows of each plot (excluding border rows) at a height of 5 cm above the ground and weighed in kilograms. A fresh sub-sample of approximately 500 g was randomly collected from each plot at the appropriate harvest stage, following the method described by Tessema (2002). Fresh weights were measured in the field using a top-loading precision laboratory balance.

Sub-samples from each plot and each plant species were separately weighed and chopped into 2–5 cm lengths for dry matter determination. To estimate dry matter yield, fresh sub-samples (FW ss) were oven-dried at 60°C for 72 hours and then reweighed to determine their dry weight (DW ss). Accordingly, leaves were separated from stems and the leaf to stem ratio (LSR) was estimated based on the dry weight of each component. Number of nodes per plant and inter node length (cm) was taken from ten randomly selected plants per plot. Then the dry matter yield per hector was calculated using the formula of (James 2008). as shown below.

DM yield (t/ha) = (10 x TFW x SSDW) / (HA x SSFW)

Where, 10 = constant for conversion of yields in kg/m2 to tone/ha; TFW = total fresh weight (kg); SSDW = sub-sample dry weight (g); HA = harvest area (m2), and SSFW = sub-sample fresh weight (g)

### Chemical Composition Analysis Procedures

Dry matter (DM) content was determined by ovendrying the samples at 105°C for 24 hours. Total nitrogen (N) content was analyzed using the Kjeldahl method, following the procedures outlined by AOAC (1990). Crude protein (CP) was then calculated by multiplying the nitrogen content by the factor 6.25 (CP = N × 6.25). Ash content was determined by incinerating the feed samples in a muffle furnace at 500°C overnight, also in accordance with AOAC (1990) procedures. Structural fiber components including Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF), and Acid Detergent Lignin (ADL) were analyzed using the detergent fiber analysis method described by Van Soest *et al.* (1991). Hemicellulose content was estimated by subtracting ADF from NDF (Hemicellulose = NDF−ADF), while cellulose content was calculated as the difference between ADF and ADL (Cellulose = ADF − ADL).

**Statistical Analysis**

Variation among Napier grass varieties were assessed using analysis of variance (ANOVA) based on the General Linear Model (GLM) procedure in SAS software (SAS, 2009). Mean comparisons were conducted using the Least Significant Difference (LSD) test at a 5% probability level. The following statistical model was applied to analyze the data:

$Y_{ijk} = \mu + G_i + E_j + (GE)_{ij} + B_k(j) + \varepsilon_{ijk}$

Where: $Y_{ijk}$ = observed value of the i-the genotype in the k-the block within the j-the environment, $\mu$ = overall mean, $G_i$ = effect of the i-the genotype, $E_j$ = effect of the j-the environment, $GE_{ij}$ = interaction effect between genotype and environment, $B_k(j)$ = effect of the k-the block within the j-the environment, $\varepsilon_{ijk}$ = residual error term.

**RESULTS AND DISCUSSIONS**

**Analysis of Variance (ANOVA)**

The analysis of variance (ANOVA) revealed that variety, location, and their interaction had highly significant (P < 0.001) effects on key agronomic traits such as plant height, number of tillers per plant, and dry matter yield. This indicates that both the genetic makeup of the Napier grass varieties and the environmental conditions of the test sites significantly influenced growth and yield. The significant variety × location interaction suggests that the performance of each variety varied across agro-ecological zones, highlighting the need for site-specific recommendations.

Nutritional parameters, crude protein (CP), ash, neutral detergent fiber (NDF), and acid detergent fiber (ADF), also showed highly significant differences due to variety, location, and their interaction. This demonstrates that the nutritional quality of Napier grass is influenced by both genetic and environmental factors, such as soil fertility and water availability.

Overall, the findings demonstrate considerable variability among varieties in terms of forage yield and nutritive value under different conditions in the Somali Region. These results emphasize the importance of multi-location testing and genotype-environment interaction in identifying suitable varieties for pastoral and agro-pastoral systems. Further on-farm trials and adaptive research are recommended to confirm and promote the best-performing varieties for improved livestock feeding systems.

**Table 1:** Combined Mean Square values from ANOVA for Napier grass varieties at Godey, Dolo and Fafan research centers.

| Source of variation | Mean Square | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | d.f. | PH | NTP | DMY T/h | CP | DM% | ASH | ADF | ADL | NDF |
| Block | 2 | 3315. | 7.5 | 327.2 | | | | | | |
| location | 2 | 1022$^{ns}$ | 985.8$^{**}$ | 11542.3$^{**}$ | 112.860$^{**}$ | 4.244$^{*}$ | 111.7416$^{**}$ | 45.443$^{**}$ | 29.1126$^{**}$ | 174.2792$^{**}$ |
| variety | 2 | 6266$^{*}$ | 9.73$^{**}$ | 3147.7$^{*}$ | 20.492$^{**}$ | 3.749$^{*}$ | 51.5898$^{**}$ | 196.177$^{**}$ | 11.5804$^{**}$ | 50.0226$^{**}$ |
| Location. Variety | 4 | 936$^{ns}$ | 4.72$^{**}$ | 380.6$^{*}$ | 0.743$^{*}$ | 3.850$^{*}$ | 18.7129$^{**}$ | 57.163$^{**}$ | 20.5231$^{**}$ | 12.1900$^{**}$ |
| Error | | 1050 | 0.93 | 600.2 | 1.250 | 1.021 | 0.6494 | 1.22 | 0.39 | 0.8141 |
| Total | 26 | | | | | | | | | |

*Keys: $^{*}$, $^{**}$: significant at 5% & 1% respectively, Df=Degree of freedom, PH=Plant height, NTP=number of tillers per plant, DM= Dry matter yield tone per hectare*

**Combined Mean Squares of Agronomic Performance of Napier Grass Varieties**

**Plant Height (PH)**

The combined analysis of variance across the three study environments revealed that plant height was highly significantly (P<0.001) influenced by variety, location (environment), and their interaction. This indicates that both genetic factors and environmental conditions, as well as their interactions, played a critical role in determining plant height. Among the evaluated varieties, 16791 exhibited the tallest plant height (215.9 cm), followed by 16784 (187.3 cm), whereas the shortest height was observed in 16819. These findings are consistent with previous reports by Arega *et al.* (2020), who also documented significant variation in plant height among different Napier grass varieties, attributed to both genetic potential and environmental adaptability.

**Number of Tillers Per Plant**

The analysis of variance also indicated a highly significant effect (P≤ 0.01) of variety, location, and their interaction on the number of tillers per plant (Table 2). This suggests a strong influence of both genotypic and environmental factors on tillering capacity. The highest number of tillers per plant was recorded for 16784 (16.46), followed closely by 16791 (16.2). In contrast, the lowest number of tillers was observed in 16819 (14.54). The observed variation in tillering could be attributed to differences in root development, nutrient uptake efficiency, and shoot regeneration capacity among the varieties. Increased root biomass generally enhances nutrient absorption, thereby promoting higher tiller production. These findings are in agreement with the study by Arega *et al.* (2020), which also reported significant varietal differences in tillering potential in Napier grass under varying agro-ecological conditions.

### Number of Nodes Per Plant

The average number of nodes per plant for the evaluated Napier grass varieties is summarized in Table 2. Statistical analysis revealed no significant differences among the varieties (p > 0.05). Across all treatments, the mean number of nodes per plant ranged from 9.1 to 10.7, with an overall average of 10.5. The highest node number (10.95) was observed in variety 16791, followed by 16819 (10.5), whereas the lowest was recorded for 16984 (9.1). These findings are consistent with previous results reported by Kebede *et al.* (2017).

### Internode Length Per Plant

The mean internode length per plant is also presented in Table 2. In contrast to node number, internode length showed statistically significant variation among the tested varieties (p< 0.05). Values ranged from 14.7 to 16.5, with a combined mean of 15.7. The longest internodes were recorded in variety 16791(16.5cm), followed by 16819 (16), while variety 16984 had the shortest internodes (14.7). These variations in internode length may be attributed to genetic differences as well as environmental factors such as soil type, temperature, rainfall distribution, and genotype × location interactions.

### Leaf to Stem Ratio at Forage Harvesting (LSR)

Leaf-to-stem ratio (LSR) data for the Napier grass varieties are shown in Table 2. No significant differences in LSR were observed among the varieties (p >0.05). The LSR ranged from 1.3 to 1.65, with an overall mean of 1.5. The highest LSR (1.65) was observed in variety 16984, followed by 16819 (1.38), while the lowest was recorded in 16791 (1.3). Compared to the present findings, Tulu *et al.* (2021) reported higher LSR values from trials conducted in Bako (1.82), Bonaya (1.94), and Gute (1.94). Conversely, lower LSR values than those found in the current study have been documented by Deribe (2013) and Jabessa *et al.* (2022).

**Table 2:** Combined mean of agronomic performance Napier grass varieties at Godey, Dolo ado and Fafan Location

| Varieties | PH | NTP | DMY(t/ha) | NNP | INL | LSR |
|---|---|---|---|---|---|---|
| 16791 | $215.9^{a}$ | $16.21^{a}$ | $27.9^{a}$ | 10.7 | $16.5^{a}$ | 1.3 |
| 16984 | $187.3^{bc}$ | $16.46^{a}$ | $17.9^{ab}$ | 9.1 | $14.7^{b}$ | 1.65 |
| 16819 | $163.1^{b}$ | $14.54^{b}$ | $14.6^{c}$ | 10.5 | $16^{ab}$ | 1.38 |
| Mean | 188.8 | 15.74 | 20.1 | 10.5 | 15.7 | 1.5 |
| CV% | 17.2 | 6.1 | 22.7 | 13.5 | 8.8 | 27 |
| LSD | 56 | 1.67 | 42.4 | 2.7 | 1.6 | 0.5 |

*Means with different superscript letter/s for varieties within the column varies significantly at 0.05. PH=Plant height, = NTP=number of tillers per plant, NNP=number of nodes per plant, INL=internode length per plant, LSR=leaf to stem ratio; CV=coefficient variation, SD=least significance difference, DMY= dry matter yield)*

### Dry Matter Yield

The analysis of variance revealed a highly significant (P ≤ 0.01) effect of variety, location, and their interaction on dry matter (DM) yield (Table 3). This indicates that both genetic makeup and environmental conditions, as well as their combined effects, significantly influenced forage yield performance across the study sites.

At the Godey and Fafan research stations, the highest DM yields were observed in variety 16791, producing 27.2 t/ha and 24.5 t/ha, respectively. In contrast, the lowest yields were recorded for variety 16819, with 14 t/ha at Godey and 16.3 t/ha at Fafan. Similarly, at the Dollo Ado station, variety 16791 also yielded the highest at 13.22 t/ha. Considering the combined mean across locations, variety 16791 consistently outperformed the other varieties, yielding 23.9 t/ha, followed by 16984, whereas the lowest combined DM yield was observed in variety 16819 (14.6 t/ha). These results underscore the superior forage production potential of variety 16791 across diverse agro-ecological conditions.

The observed differences in DM yield among varieties may be attributed to genotypic variations in growth habits, tillering ability, and nutrient use efficiency. The superior performance of varieties 16791 and 16984 could be linked to their vigorous growth, robust root systems, and enhanced morphological development (e.g., taller plant height and a greater number of tillers), which contribute to higher biomass accumulation.

These findings are consistent with previous reports by Inyang *et al.* (2010) and Feyissa *et al.* (2014), who reported that Napier grass varieties with more tillers and taller stature generally produce higher forage yields. Similarly, studies by Tessema *et al.* (2002) and Ishii *et al.* (2005) demonstrated a strong positive correlation between plant height, tillering capacity, and dry matter yield, supporting the results of the current study.

**Table 3:** Dry matter yield of Napier grass varieties as affected by location at Fafan, Dolo and Godey.

| Varieties | Fafan | Godey | Dolo- Ado | Combined Mean |
|---|---|---|---|---|
| 16791 | 24.5[a] | 27.2[a] | 13.22[a] | 23.9[a] |
| 16984 | 19.3[b] | 24.1[b] | 14.44[a] | 17.9[ab] |
| 16819 | 16.3[c] | 14[c] | 12.78[a] | 14.6[c] |
| Mean | 20.3 | 21.8 | 13.48 | 19 |
| CV% | 0.1 | 3.7 | 4.4 | 2.7 |
| LSD | 0.05 | 12.04 | 18 | 22.4 |

## Combined Mean Squares ANOVA for Chemical Composition of Napier Grass Varieties

### Dry Matter Content (DM%)

The analysis of variance revealed a highly significant effect ($P \leq 0.01$) of variety, location, and their interaction on dry matter (DM) content of Napier grass (Table 4). Among the tested varieties, 16791 exhibited the highest combined mean DM content (93.06%), followed by 16984 (92.18%), while the lowest DM content was observed in 16819 (91.8%). The significant variation in DM content among the varieties may be attributed to inherent genetic differences and adaptive responses to environmental conditions. These findings are consistent with those reported Arega *et al.* (2020), who observed similar variability in DM content among Napier grass genotypes.

### Ash Content (%)

Ash content was significantly influenced ($P \leq 0.01$) by the effects of variety, location, and their interaction (Table 4). The highest ash content was recorded for 16819 (19.5%), whereas the lowest was noted for 16791 (14.3%). This difference in mineral residue may be associated with genetic differences in nutrient uptake and accumulation among the varieties. The results align with those reported by Habtie Arega *et al.* (2020), indicating a similar pattern in ash content across different Napier genotypes.

### Neutral Detergent Fiber (NDF%)

NDF content, which reflects the cell wall components such as hemicellulose, cellulose, and lignin, showed a highly significant variation ($P \leq 0.01$) across varieties, locations, and their interaction (Table 1). 16984 recorded the highest NDF content (86.6%), suggesting a higher proportion of fibrous material, while 16791 had the lowest NDF value (82.49%), implying potentially better digestibility. These results are in agreement with the findings of Habtie Arega *et al.* (2020), who also reported variation in fiber content among Napier grass varieties.

### Acid Detergent Fiber (ADF%)

Similarly, ADF content, which represents the least digestible fiber components (cellulose and lignin), was significantly affected ($P \leq 0.01$) by the main factors of variety, location, and their interaction (Table 4). 16819 exhibited the highest ADF content (56.9%), while the lowest value was recorded for 16791 (47.6%). This difference may reflect the influence of genetic factors and environmental interactions on fiber biosynthesis and accumulation in plant tissues. Higher ADF values typically suggest reduced forage digestibility, reinforcing the superior nutritive quality of 16791.

**Table 4:** Combined mean for chemical compositions of Napier grass variety grown under Fafan, Gode and Dolo Research centers.

| Varieties | DM% | ASH | ADL | ADF | NDF |
|---|---|---|---|---|---|
| 16791 | 93.06[a] | 14.73[c] | 11.6[b] | 47.62[c] | 82.49[b] |
| 16819 | 91.8[b] | 19.5[a] | 13.73[a] | 56.91[a] | 82.55[b] |
| 16984 | 92.18[ab] | 16.88[b] | 11.98[b] | 51.44[b] | 86.6[a] |
| Mean | 92.35 | 17.04 | 12.44 | 51.99 | 83.88 |
| CV% | 1.1 | 4.7 | 5.1 | 2.1 | 1.1 |
| LSD | 1.73 | 1.38 | 1.01 | 1.89 | 1.55 |

*DM%= dry matter percent, CP = Crude protein; Ash= Ash percentage; NDF= Neutral detergent fiber; ADF= Acid detergent fiber; LSD: Least Significance difference; CV= coefficient variation=Napier grass)*

### Crude Protein Content (CP %)

The analysis of variance revealed a highly significant difference ($P<0.001$) in crude protein (CP) content among the varieties, locations, and their interaction (Table 1). At the Fafan location, the highest CP content was recorded in 16791 (14.34%), while the lowest was observed in 16984 (10.9%). In contrast, at the Godey location, 16819 exhibited the highest CP content (8.2%),

followed by 16791 (7.66%). For Dollo-Ado, the highest CP content was found in 16819 (7.77%), whereas 16984 recorded the lowest CP content (5.5%).
Regarding the combined mean, the highest CP content was observed in 16791 (10.1%), while 16984 exhibited the lowest average CP (7.3%). The observed variation in CP content across varieties and locations suggests differences in the nitrogen utilization and protein synthesis capacities of the varieties, as well as the influence of environmental factors on the plant's ability to accumulate protein. These findings are in agreement with those of Arega *et al.* (2020), who also reported significant variability in CP content among Napier grass varieties.

**Table 5:** Crude protein content (CP) of Napier grass based on locations

| | Locations | | | |
|---|---|---|---|---|
| **Varieties** | **Fafan** | **Godey** | **Dolo-Ado** | **Combined Mean** |
| 16791 | 14.34[a] | 7.66 | 7.52[a] | 9.81[a] |
| 16819 | 14.27[a] | 8.2 | 7.77[a] | 10.102[a] |
| 16984 | 10.93[b] | 5.2 | 5.93[b] | 7.36[b] |
| Mean | 13.18 | 7.02 | 7.07 | 9.09 |
| CV% | 2.9 | 26.8 | 3.3 | 12 |
| LSD | 0.76 | 3.8 | 0.5 | 1.92 |

*(CV=coefficient variation; LSD=least significant difference*

## CONCLUSIONS

The analysis of variance (ANOVA) revealed significant differences among the evaluated Napier grass genotypes in plant height, tiller number, Internode length per plant, dry matter yield, and nutritional quality across all test environments. Among these, genotypes ILRI-16791 and ILRI-16984 demonstrated superior combined mean yields, highlighting their potential as the most promising candidates for future cultivation. All tested varieties showed strong adaptability and consistent productivity across diverse agro-ecological zones, offering a practical solution to the widespread shortage of high-quality livestock feed in the region. Particularly, 16791 and 16984 not only produced high dry matter yields but also exhibited favorable nutritional profiles characterized by elevated crude protein levels and reduced concentrations of ADF, NDF, and ADL making them excellent energy-rich supplements for areas heavily dependent on low-quality roughage and crop residues. Based on these findings, genotype ILRI-16791 is recommended for Fafan and similar environments due to its superior dry matter and protein content, while genotype ILRI-16984 is better suited for Godey and Dollo-Ado, where it achieved higher dry matter yields and notable crude protein levels. To fully realize their potential, further research is recommended to explore the detailed chemical composition of these genotypes and assess their effects on live-animal performance. Additionally, studies on the agronomic performance of Napier grass across varying seasons and environmental conditions are necessary to ensure sustained productivity and adaptability over time. Further studies of Agronomic performance of Napier grass across different seasons and locations should be conducted.

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