Hindawi
International Journal of Agronomy
Volume 2024, Article ID 6170361, 8 pages
https://doi.org/10.1155/2024/6170361

Research Article

Herbage Yield and Nutritive Value of Selected Grasses in Subhumid Agroecological Environments in Ethiopia

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Received 29 May 2023; Revised 28 April 2024; Accepted 2 May 2024; Published 10 May 2024

Academic Editor: Francesca Degola

The introduction of improved forage varieties could play a crucial role in meeting the growing demand for livestock and livestock products in Ethiopia. However, different cultivars exhibit varied performance. Therefore, this study aimed to assess the performance of *Brachiaria* cultivars and other grass cultivars in two subhumid agroecological areas of Ethiopia. Four *Brachiaria* cultivars (*B. brizantha* (DZF-13379), *B. humidicola* (DZF-9222), *B. decumbens* (DZF-10871), and *B. mutica* (var. DZF-483), and two local grass cultivars, Rhodes grass (*Chloris gayana* var. Massaba) and Desho grass (*Pennisetum glaucifolium* var. Kindu Kosha), were evaluated in Bako and Bishoftu for three years during the rainy season. The experiment was carried out using a completely randomized block design. Results indicated that both cultivars and years had significant ($P < 0.001$) effects on herbage dry matter (DM) yield, crude protein (CP) yield, and plant height, whereas location only affected DM yield. Significant cultivar × year interactions were observed for DM yield, CP yield, and plant height, while cultivar × location interactions had a significant effect on all parameters except for CP yield. Additionally, cultivars significantly ($P < 0.001$) impacted the in vitro dry matter digestibility (IVDMD) as well as the nutritional content (CP, ash, acid detergent lignin (ADL), neutral detergent fiber (NDF), and acid detergent fiber (ADF). Overall, all cultivars demonstrated potential as alternative ruminant feeds, with *B. mutica*, followed by *B. brizantha*, showing superior performance in the subhumid agroecological areas of Ethiopia.

1. Introduction

There is substantial evidence that the livestock sector significantly contributes to Ethiopia's national economy and livelihood system. The sector accounts for approximately 40 percent of agricultural GDP, up to 20 percent of national GDP [1]. This sector serves multiple functions, including food and nutritional security, as a source of milk and meat, income, manure, and draught power for smallholder farmers. However, it contributed far less than expected, mainly because of feed shortages [2, 3]. The availability of feed in Ethiopia's crop and livestock systems depends mainly on natural pastures and crop residues [4]. Whereas these feed resources are threatened by overexploitation and lack of high-quality feed [3, 5]. Furthermore, pressures arising from climate change and variability exacerbate these long-standing feed problems [6]. These drawbacks highlight the importance of introducing improved forage in addition to the existing feeding systems [7].

Brachiaria (*syn. Urochloa*) are among the potential grasses that are important for sustainable forage production and are resilient to the detrimental effects of climate change [8, 9]. It is the source of many tropical grass species that originate in Africa and are widely grown in tropical Latin America and South Asia [10]. Consequently, there has been a surge of interest in *Brachiaria* grass in East Africa [11–13].

This is due to its adaptability to a wide range of soils, climates, and growing conditions in both the tropics and subtropics [14, 15]. Moreover, *Brachiaria* grasses have shown promising results in improving livestock productivity as they have better nutritional quality and biomass production [16]. Furthermore, *Brachiaria* grasses have several environmental benefits, such as the ability to sequester carbon, increase nitrogen use efficiency through biological nitrification inhibition (BNI), effectively cover crops to control soil erosion, and crop pests through push-pull pest management [17–19].

Desho grass (*Pennisetum glaucifolium*) is an indigenous forage grass species in Ethiopia. In addition to its use as animal feed, Desho grass conserves soil water and serves as a means of income generation for smallholder farmers. Desho thrives well in different soil types, has the potential to produce large amounts of biomass per unit area, is suitable for different forage production strategies, is acceptable for different livestock species, and increases livestock productivity [20]. Morphologically, it is closer to the *genus Brachiaria*, which shares the acidic and wetter areas of Ethiopia [21]. Rhodes grass (*Chloris gayana*) is a tropical grass widely used in grazing and cut and carry systems in warm areas. *Chloris gayana* is best suited to areas with 600–1200 mm of rainfall. It is moderately drought tolerant, grows best at high temperatures, and is relatively frost tolerant [22].

To capitalize on these potential forages and close the feed deficit gap, the comparative evaluation of Brachiaria with other important grass species should be the main research approach to demonstrate the suitability of forage for greater adoption in Ethiopia [7]. As a result, understanding the influence of environmental factors and management practices on forage productivity is critical for optimizing feed production and utilization to increase animal productivity [23, 24]. Information regarding these factors is critical for optimizing feed production and utilization to increase animal productivity. In addition, it is also important to document information on the nutritional value of feeds for their inclusion in livestock feeding programs [25].

This study aimed to compare the growth, herbage accumulation, and nutritive value of four *Brachiaria* cultivars, *B. brizantha* (DZF-13379), *B. humidicola* (DZF-9222), *B. decumbens* (DZF-10871) and *B. mutica* (DZF-483), and two local grass cultivars, Desho grass (*Pennisetum glaucifolium* var. Kindu Kosha) and Rhodes grass (*Chloris gayana* var. Massaba) in two subhumid agroecological in Ethiopia. The information generated will help identify promising grass cultivars for further utilization under the subhumid agroecological conditions.

2. Materials and Methods

2.1. Study Sites. The experiment was carried out at Debre Zeit Agricultural Research Center (Bishoftu), (08° 44′N, 38°38′E; elevation: 1900 masl), and the Bako Agricultural Research Center, (09^{0}06′N, 37^{0}09′E; elevation: 1650 masl), in the subhumid agroclimatic zone of central and western Ethiopia, respectively. The average minimum and maximum temperatures were 9.2 and 14.35°C, and 26.55 and 28.65°C, whereas mean annual rainfall was 854 and 1281 mm for Debre Zeit and Bako Agricultural Research Center, respectively, for test years (2020–2022). The rainfall pattern is bimodal with the main rainy season (*Kiremt*) occurring between June and September and the short rains (*Belg*) from February through May [26]. The soil type in the Debre Zeit center is predominantly Eutric vertisol, Vitric Andosols, and Haplic Andosols [27], while the experimental plots were laid out on Eutric vertisol with a clay texture and a neutral to slightly alkaline pH. The dominant soil type in the Bako center is Alfisols, which are clay in texture and acidic [28].

2.2. Plant Materials, Experimental Design, and Treatments. Vegetative root split planting materials were collected from the Debre Zeit Agricultural Research Center (DZARC) and transplanted in mid-June 2020 under natural precipitation condition. Six grass cultivars were used: four *Brachiaria* cultivars (*B. brizantha* (DZF-13379), *B. humidicola* (DZF-9222), *B. decumbens* (DZF-10871), and *B. mutica* (var. DZF-483)) and two other grass cultivars, Desho grass (*Pennisetum glaucifolium* var. Kindu Kosha) and Rhodes grass (*Chloris gayana* var. Massaba). *Brachiaria* cultivars were selected based on their superior performance in previous trials in DZARC (unpublished data), while a recently released grass variety, Desho grass [7], and a popular grass species, Rhodes grass, were used as controls.

Experiments were conducted in each location using a completely randomized block design with three replicates. Three blocks, each containing 6 plots of a well-prepared 12 m^2 (3 by 4 m) were used for the experiment. The vegetative materials were transplanted with the spaces between rows and within plants of 50 cm and 25 cm, respectively. The transplanted materials were of the same age, and 2-3 plants were placed in each hole at a depth of 10 cm. Nitrogen and phosphorus fertilizers were applied at a rate of 18 N and 46P kg/ha (DAP) at sowing and soon after harvesting in a band along the planting furrow. Hand weeding management practices were performed when appropriate.

2.3. Data Collection and Measurement. The trial plots were regularly monitored, and data on growth performance including plant height and herbage accumulation were measured during the rainy seasons (June–Sept). Plant height (cm), which is the distance from the soil surface to the uppermost point of the stem as the mean of five randomly selected plants (one per crown) from the middle row of each plot, was measured immediately during each harvesting. The first harvest was carried out three months after the establishment period; in the following year, after clipping at the early onset of the rainy season, it was harvested at an interval of 60 days until the end of the rainy season, leaving a stubble height of 10 cm above the ground by hand using a sickle. The fresh herbage yield was taken in the field immediately after the entire plot was mowed for each harvest, and a sample of 300 g was taken. The sample was immediately cut into small pieces and placed in a draft oven at 65°C for 72 h to determine the dry matter yield. Simultaneously, a composite sample of 400 g for each treatment was collected and dried in the shade for laboratory analysis. Herbage DM yield was calculated by multiplying fresh forage biomass by the respective DM concentration of the samples. Herbage DM yield (HDY) was calculated as follows: HDY ($DMha^{-1}$) = $HDY{\cdot}ha^{-1}$. Crude protein (CP) yield ($CPY{\cdot}ha^{-1}$) was calculated as HDY × CP concentration in the forages (determined after laboratory analysis).

2.4. Laboratory Analysis. Chemical analyses of the feed samples were performed at the Debre Zeit and Holetta Agricultural Research Centers' Feed and Animal Nutrition Laboratory. The grass samples were dried at 105°C overnight and ground to pass through a 1 mm sieve. The total DM was then determined. The nitrogen (N) content was determined using *the Kjeldahl* method, and CP was calculated as $N \times 6.25$. The total ash content was determined by igniting the samples in a muffle furnace overnight at 550°C. Neutral detergent fiber (NDF), acid detergent fiber (ADF), and acid detergent lignin (ADL) were determined according to [29]. *In vitro* organic matter digestibility (IVOMD) was determined using the modified Tilley and Terry method [30].

2.5. Statistical Analysis. All data were analyzed using a linear mixed model approach through the *Lmer* function in R, v. 4.1.2 (R Foundation for Statistical Computing, https://www.r-project.org). For mean comparisons, cultivars, location, year, and their interactions were treated as fixed factors. In all cases, the block, the interaction of location, and the year were treated as random factors. Mean comparisons of the effect were performed using the "*lsmeans*" package in R [31]. We assessed these *lsmeans* over locations and years, given their general interest for subhumid environments of Ethiopia. However, we assessed the value of the individual cultivars in the single sites and years, for plant height, DM yield, and CP yield traits that displayed significant cultivar × location and cultivar × year interactions. Nutritive value parameters were analyzed using one-way ANOVA for the significant difference among the grass cultivars. Tukey's honestly significant difference post hoc test was used to separate significant differences between cultivars. The statistical model used for the analysis of DM yield and other related agronomic traits was as follows: $Yijkx = \mu + Cj + Lk + Yx + (Cj * Lk) + (Cj * Yx) + (Cj * Lk * Yx) + \varepsilon ijkx$, where $Yijkx$ is the response variable, μ is the overall mean, Cj is the effect of *the* j^{th} grass cultivar, Lk is the effect of *the* k^{th} location, Yx is the effect of x^{th} year, $Cj * Lk$ is the interaction between cultivars and locations, $Cj*Yx$ is the interaction between cultivar and year, $Cj * Lk * Yx$ is the interaction among cultivar, location, and year, and $eijxk$ is the random error.

3. Results

3.1. Effects of Cultivars, Location, Year, and Their Interactions on Yield and Yield Components. Variations among cultivars over locations and years were significant ($P < 0.001$) for plant height, dry matter (DM) yield, and crude protein (CP) yield (Table 1). In addition, cultivar × year and cultivar × location interactions were significant ($P < 0.05$) for the DM yield and plant height. However, despite the variability in environmental conditions across the two growing locations, CP yield was not affected by the cultivar × location interaction.

Table 1: Statistical probabilities of *the F criterion* of six cultivars tested for three years (2020–2022) in subhumid environments in central and western subhumid environments.

Source of variation	D.F	PH	DM yield ($t{\cdot}ha^{-1}$)	CP yield ($t{\cdot}ha^{-1}$)
			F-test	
Cultivar (C)	5	***	***	***
Location (L)	1	ns	**	ns
Year (Y)	2	***	***	***
C∗L	5	***	*	ns
L∗Y	2	***	ns	*
C∗Y	10	***	***	***

D.F., degrees of freedom; PH, plant height; DM, dry matter; CP, crude protein. t·ha-1 = tons per hectare. *, **, and ***: significance at $P < 0.05$, 0.01, and 0.001, respectively.

3.2. Growth and Yield Performance. Combined analyses showed that *B. mutica* was a significantly ($P < 0.05$) top-ranking cultivar in terms of dry matter yield (Table 2). *B. brizantha* and Desho grass ranked the second and third highest DM yields, respectively, but they did not differ ($P > 0.05$) from all cultivars except for *B. humidicola.* Low DM yield was observed for *B. humidicola* but did not differ ($P > 0.05$) from *B. decumbens* and Rhodes. In Bishoftu, *B. mutica* showed the highest DM yield but did not differ ($P > 0.05$) from all other cultivars except for *B. humidicola.* Similarly, although a low DM yield was observed for *B. humidicola*, it did not differ ($P > 0.05$) from Rhodes and *B. decumbens*. *B. mutica*, followed by *B. brizantha*, had the highest DM yield in Bako. However, *B. brizantha* did not differ ($P > 0.05$) from Desho and *B. decumbens.* Low DM yield was observed for Rhodes grass but did not differ ($P > 0.05$) from *Brachiaria* (*humidicola* and *decumbens*) and Desho.

Compared to the experimental year, a relatively low dry matter yield was obtained during the year of establishment (2020) for all cultivars. Desho grass, followed by *B. mutica* and Rhodes grass, showed significantly ($P < 0.05$) the highest DM yield in 2020. *Brachiaria* (*humidicola* and *brizantha*) showed the lowest DM yield during the establishment year. In 2021, all cultivars showed their own maximum DM yield, except for *B. brizantha,* which had shown the highest in 2022. *B. mutica* showed the highest DM yield in 2021 but did not differ ($P > 0.05$) from *Brachiaria* (*decumbens* and *brizantha*) or Desho. *B. humidicola,* which exhibited the lowest DM yield, did not differ ($P > 0.05$) from Rhodes. In 2022, *B. brizantha,* followed by *B. mutica*, showed significantly ($P < 0.05$) the highest DM yield. Low DM yield was observed for Rhodes, while it did not differ ($P > 0.05$) *from Brachiaria* (*humidicola* and *decumbens*) Desho grass.

Like for DM yield, *B. mutica* attained the highest plant height but did not differ ($P > 0.05$) from *B. brizantha* and Rhodes grass (Table 3). In contrast, *B. humidicola* achieved a lower plant height. *B. mutica* showed significantly ($P < 0.05$) the highest plant height in both locations. *B. brizantha* had the second highest plant height but did not differ ($P > 0.05$) from Rhodes grass in Bishoftu, while vice

Table 2: DM yield (t ha^{-1}) (*LS means*) of grass cultivars tested for three years in two locations.

Cultivar	Location		Year			Combined analysis
	Bishoftu	Bako	2020	2021	2022	
B. mutica (var. DZF-483)	13.57^{a}	12.84^{a}	6.82^{ab}	17.2^{a}	15.59^{ab}	13.2^{a}
B. brizantha (DZF-13379)	11.46^{a}	11.23^{ab}	2.59^{c}	14.64^{abc}	16.8^{a}	11.34^{ab}
Desho grass (var. Kindu Kosha)	12.94^{a}	9.67^{bc}	8.78^{a}	14.66^{abc}	10.48^{c}	11.30^{ab}
B. decumbens (DZF-10871)	11.2^{ab}	9.57^{bc}	4.04^{bc}	15.01^{ab}	12.11^{bc}	10.39^{bc}
Rhodes grass (var. Massaba)	11.11^{ab}	8.31^{c}	7.87^{a}	12.24^{bc}	9.03^{c}	9.71^{bc}
B. humidicola (DZF-9222)	8.57^{b}	8.19^{c}	2.2^{c}	11.38^{c}	11.56^{c}	8.38^{c}
Mean	11.5	9.97	5.38	14.21	12.6	10.72
SEM	0.68	0.68	0.83	0.83	0.83	0.48
P-level	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001

^{a,b,c,d}means with different letters are significantly different.

Table 3: Plant height (cm) (*LS means*) of grass cultivars was tested for three years at two locations.

Cultivars	Location		Year			Combined analysis
	Bishoftu	Bako	2020	2021	2022	
B. mutica (var. DZF-483)	116.2^{a}	127.7^{a}	136^{a}	123^{a}	106.8^{a}	121.9^{a}
B. brizantha (DZF-13379)	96.5^{b}	104.3^{b}	94.8^{c}	103.2^{b}	103.2^{a}	100.4^{ab}
Rhodes grass (var. Massaba)	98.2^{b}	99.8^{bc}	111^{b}	97.2^{b}	88.8^{b}	99.0^{ab}
B. decumbens (DZF-10871)	91.1^{bc}	93.7^{c}	89.8^{cd}	89.8^{cd}	86.3^{b}	92.4^{c}
Desho grass (var. Kindu Kosha)	85.8^{cd}	79.4^{d}	82.7^{cd}	79.8^{c}	85.3^{b}	82.4^{d}
B. humidicola (DZF-9222)	79.2^{d}	70.4^{e}	77.5^{d}	79.8^{c}	67.2^{c}	74.8^{e}
Mean	94.5	95.9	98.63	95.47	89.6	94.63
SEM	0.87	0.87	3.34	3.34	3.34	6.02
P-level	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

^{a,b,c,d,e}means with different letters are significantly different.

versa in Bako. Throughout the years, the highest plant height was observed for *B. mutica,* although it did not differ significantly ($P > 0.05$) from *that of B. brizantha* in 2022. Low plant height was observed in *B. humidicola* throughout the experimental period.

3.3. Crude Protein Yield. The crude protein yields of perennial grass cultivars over three years in the two locations are shown in Table 4. The results of the combined analysis showed that the crude protein yield was significantly ($P < 0.001$) influenced by the cultivars. *B. mutica* had the highest crude protein yield but did not differ ($P > 0.05$) from *B. brizantha*. Similarly, the highest crude protein yield was observed for *B. mutica*, followed by *B. brizantha,* at both locations. In the establishment year (2020), *B. mutica* had the highest crude protein yield but did not differ from Desho and Rhodes grass. Low CP yield was observed for *B. humidicola* but did not differ ($P > 0.05$) from *B. decumbens* and Desho. Similarly, in 2021, *B. mutica,* followed by *B. brizantha*, and *B. humidicola,* showed the highest ($P < 0.05$) crude protein yield. In 2022, *B. brizantha* had the highest crude protein yield, followed by *B. mutica*, while *B. humidicola* ranked third in this regard. However, there were no significant differences ($P > 0.05$) observed among the other cultivars.

3.4. Nutritional Content. The combined analysis of the nutritive composition of the forage grass cultivars grown for three years in two locations is presented in Table 5. The crude protein content (CP%) was significantly ($P < 0.01$) influenced by cultivar. A higher CP content was observed in *Brachiaria* (*humidicola*, *mutica*, and *brizantha*). A low CP content was observed for Desho grass. The NDF content did not differ ($P > 0.05$) in any of the grass cultivars tested. The ADF content was significantly ($P < 0.01$) influenced by cultivar. The highest ADF value was observed for Rhodes grass, but it did not differ significantly ($P < 0.05$) from all cultivars tested except for *B. mutica*.

The ash content was significantly ($P < 0.01$) influenced by cultivar (Table 5). The highest ash content was observed in *B. humidicola*, followed by *Brachiaria* (*brizantha* and *decumbens*). Low ash content was observed for Desho grass and Rhodes grass but did not differ for *B. mutica.* The lignin concentrations of the tested cultivars did not differ significantly ($P > 0.05$). *In vitro* dry matter digestibility was significantly ($P < 0.001$) influenced by the cultivar (Table 5). *B. humidicola* was superior to all investigated grass cultivars in terms of *in vitro* dry matter digestible content but did not differ ($P > 0.05$) from *B. brizantha*. *B. mutica* showed the third *in vitro* dry matter digestibility content but did not differ ($P > 0.05$) from Desho and *B. decumbens*. Rhodes grass had a low *in vitro* dry matter digestibility content.

4. Discussion

The test locations represent the diversity of rainfall, temperature patterns, and soil types that characterize the subhumid environments of central and western Ethiopia. The amount of rainfall that covers more than 70% during the

Table 4: Crude protein yield (t·ha^{-1}) (LS means) of the cultivars tested for three years at two locations.

Cultivar	Location		Year			Combined analysis
	Bishoftu	Bako	2020	2021	2022	
B. mutica (var. DZF-483)	1.67[a]	1.62[a]	0.92[a]	2.02[a]	2[ab]	1.64[a]
B. brizantha (DZF-13379)	1.43[ab]	1.41[ab]	0.33[c]	1.75[ab]	2.18[a]	1.42[ab]
B. humidicola (DZF-9222)	1.19[bc]	1.19[bc]	0.25[c]	1.63[abc]	1.68[b]	1.19[bc]
B. decumbens (DZF-10871)	1.1[bc]	1[c]	0.43[bc]	1.5[bc]	1.22[c]	1.05[c]
Desho grass (var. Kindu Kosha)	1.09[bc]	0.84[c]	0.63[abc]	1.27[c]	1[c]	0.97[c]
Rhodes grass (var. Massaba)	1.06[c]	0.98[c]	0.78[ab]	1.3[c]	0.97[c]	1.02[c]
Mean	1.26	1.18	0.57	1.59	1.5	1.21
SE	0.09	0.09	0.11	0.11	0.11	0.06
P-level	<0.08	<0.08	<0.001	<0.001	<0.001	<0.001

[a,b,c,d]means with different letters are significantly different.

Table 5: Nutrient composition of grass cultivars tested in central and western subhumid areas.

Cultivar	CP	NDF	ADF	Ash	ADL	IVDMD
B. humidicola (DZF-9222)	13.3[a]	72.1	41.5[ab]	11.32[a]	8.44	59.2[a]
B. mutica (var. DZF-483)	12.7[a]	75.3	39.8[b]	8.82[b]	8.81	53.9[b]
B. brizantha (DZF-13379)	12.5[a]	72.2	44.9[ab]	8.27[b]	10.55	56.2[ab]
Rhodes grass (var. Massaba)	10.5[b]	77	47.2[a]	8.62[b]	9.24	50[c]
B. decumbens (DZF-10871)	10.5[b]	73.7	42.9[ab]	9.79[ab]	9.62	50.4[c]
Desho grass (var. Kindu Kosha)	8.6[c]	72.3	44.2[ab]	8.69[b]	8.3	55.5[b]
Mean	11.35	73.73	43.42	9.25	9.16	54.19
SEM	0.51	1.9	1.3	0.49	1.63	0.92
P-level	<0.001	0.15	<0.001	<0.001	0.58	<0.001

[a,b,c,d]Means with different letters are significantly different; CP: crude protein; NDF: neutral detergent fiber; ADF: acid detergent fiber; ADL: acid detergent lignin; IVDMD: *in vitro digestibility of* dry matter.

main rainy season (*Kiremt*) and the higher temperatures that occurred in the test years relative to the long-term data are consistent with the predicted effects of climate change in the region [32] and add interest to our results from the perspective of future climate scenarios on forage grasses.

Because growing circumstances varied between test sites and years, it was hypothesized that cultivar × location and cultivar × year interactions would show up in forage yield attributes. Indeed, the patterns of microclimate (rainfall and temperature) and soil differed slightly between the experimental sites and years, which affected the yield of the grass cultivars. This implies a change in the ranking order of cultivars over location and year. The significant interaction of the yield traits in the current study was in agreement with the report by Wassie et al. [33] which showed a significant effect of the interactions (cultivar × altitude and cultivar × harvest date) on *Brachiaria brizantha* in northwest Ethiopia.

Our findings supported earlier reports that *Brachiaria mutica* (var. DZF-483) is a high forage yielding in subhumid conditions [34, 35]. In addition to its DM yield, *B. mutica* had the highest CP yield among the tested cultivars. The dry matter yield of forage *Brachiaria mutica* (DZF-483) obtained in our results (13.2 t·ha^{-1}) was comparable to the result (13.3 t·ha^{-1}) reported during its variety registration [34] and higher than the result of 11.8 t·ha^{-1} that was reported in the northwest highlands of Ethiopia by Bantihun et al. [35].

Brachiaria brizantha (DZF-13379) ranked second and showed an increasing trend from year to year in forage dry matter yield in our study, which indicated the potential and importance of this cultivar. The Debre Zeit Agricultural Research Center Forage program team has chosen this cultivar as a candidate variety for registration, and our results validate and complement their earlier work (unpublished data). The average result of 5.4 t·ha^{-1} reported for *Brachiaria brizantha* ecotypes cultivated at low and mid-altitudes in northwest Ethiopia was less than the dry matter yield of *B. brizantha*, which was 11.34 t·ha^{-1} in the current study [33].

In contrast, the dry matter yield of Desho grass (*P. glaucifolium* cv. Kindu Kosha) varied with location (altitude) from high in Bishoftu to moderately low in Bako, from 12.94 to 9.67 t·ha^{-1}, respectively. The current results for the dry matter yield of Desho grass were also lower than those reported in other studies conducted at higher altitudes in Ethiopia [36–38]. This is in agreement with Mengistu et al. (2019), who indicated that highland environments were more ideal for the growth and development of Desho grass species.

The dry matter yield obtained for *Brachiaria decumbens* (10.39 t·ha^{-1}) in our study was lower than that reported for *U. decumbens* (11.40 t·ha^{-1}) under supplementary irrigation conditions in Holetta, Ethiopia, by Faji et al. [36], which might be due to irrigation supplementation. Rhodes grass (*Chloris gayana* cv. Massaba) forage dry matter yield in our study, 9.71 t·ha^{-1}, was much lower than that reported by Faji et al. [36], which was 14.93 t·ha^{-1} and reported irrigation supplementation in Holetta, Ethiopia. On the other hand, although the dry matter yield of *Brachiaria humidicola* was the lowest, this cultivar has higher CP and IVDMD. It ranked third in CP yield, indicating better nutritional importance. Other researchers also confirmed that, in addition to its good forage, this cultivar is known for its restoration ability when established on degraded land [39].

In this study, all cultivars had CP concentrations >7%, which met the minimum crude protein requirements (7%) for the synthesis of microbial proteins in the rumen that can support at least the maintenance requirements of ruminants [40]. The CP concentration for *Brachiaria mutica* in our study was slightly higher than the result of 11.6, reported by Bantihun et al. [35]. The *B. decumbens* Desho and Rhodes cultivars were also higher than the result reported by Faji et al. [36] in Holetta under irrigation supplementation. On the contrary, the CP concentration of Rhodes grass is much lower than the result reported by Jayasinghe et al. [41]. Furthermore, as Faji et al. [36] cited Lonsdale (1984), the feeds were classified based on their CP concentration as low, medium, and high protein sources with percentages of <12%, 12–20%, and >20% CP, respectively. *Brachiaria* (humidicola and *mutica*) was classified as a medium-protein feed source, whereas the other tested cultivars were classified as low-protein feed sources.

Fiber content (defined by NDF and ADF), an estimate of the amount of plant cell wall rather than cell content, is inversely related to digestibility and forage intake. Therefore, a high content of NDF indicates the indigestible portion of the feed, which is an indicator of the quality of the feed. Our results for the NDF content for all grass cultivars fell above 65%. According to Van Soest [42], NDF content of tropical grasses within the limit (65% and above) is classified as low-quality roughage feed. However, our results disagreed with the result reported by Faji et al. [36] that perennial grass species varied in NDF content. Similarly, the ADF content is an indicator of forage intake. Forage grasses with a higher ADF content have a lower intake [42]. In the present study, *B. mutica* (var. DZF-483) can be considered to have a higher intake than other evaluated perennial grass cultivars. The varied ADF content of the cultivars observed in our study could be due to the genotypic and phenotypic characteristics of the grass cultivars.

The ash content of any feed is a positive indicator of the inorganic content (minerals) and an indirect estimator of the organic matter content. Most forages had ash contents ranging from 5 to 12%, which is in agreement with the results of Wassie et al. [33]. According to Van Soest [42], a lignin content greater than 6% negatively affects the digestibility of grass forage and the evaluated grass cultivars in the current study had higher values. In the current study, *in vitro* dry matter digestibility declined slightly with an increase in NDF, ADF, and ADL. This may be due to the fact that higher levels of NDF, ADF, and ADL induce lignin to be deposited in the cell walls and increase the percentage of stems, which are less digestible than the leaf section that has a high fiber and lignin content [42]. Our results were consistent with Faji et al. [36], who reported that IVDMD levels of perennial grasses were inversely proportional to NDF, ADF, and ADL, which are more slowly degraded in the rumen, affecting microbial synthesis and animal performance. Similarly, the variation in the nutritional composition in our results is consistent with the results of Faji et al. [36], who reported that the nutritional composition of forage crops can vary with genotypic characteristics and environmental conditions.

5. Conclusions

This study comprehensively evaluated the growth, herbage accumulation, and nutritional value of various forage grass cultivars in two subhumid agroecological zones in Ethiopia. The findings underscore the significance of considering environmental conditions and cultivar characteristics in selecting forage grasses. *Brachiaria mutica* (var. DZF-483) appeared as the top-performing cultivar, excelling in dry matter yield and crude protein yield across the test locations and years. Following closely, *Brachiaria brizantha* (DZF-13379) showed promising potential with the second highest dry matter yield. Our findings have important implications for selecting target grass cultivars for adaptation and utilization. Therefore, we recommend *Brachiaria mutica* (var. DZF-483) and *Brachiaria brizantha* (DZF-13379) as preferentially recommended in the study areas as alternative forage grasses due to their higher biomass production and acceptable nutritional value. Finally, further studies should be conducted on the performance of animals fed these grass cultivars as a basal diet, aiming to fine-tune the concentrate supplementation recommended for livestock producers.

Data Availability

The datasets used and/or analyzed in this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

FD contributed to the research proposal writing, data collection, analysis, interpretation, and article writing. AM, DG, DD, and FF contributed to the research proposal, writing, and editing. All authors have read and approved the final manuscript.

Acknowledgments

The authors thank Addis Ababa University, Wallaga University, and the Ethiopian Institute of Agricultural Research for their financial support in conducting this study. The authors are also grateful to the technical and field assistants of the Forage and Pasture Research program, Debre Zeit Agricultural Research Center, and Bako Agricultural Research Center for their support during the fieldwork for data collection. The authors also acknowledge Debre Zeit and Holetta laboratory technicians and researchers working in animal nutrition for their support during laboratory analysis.

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