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Research Article

Agronomic Performance, Yield, and Nutritional Value of Grasses Affected by Agroecological Settings in Ethiopia

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One of the major limiting factors of livestock production in Ethiopia is the very low quantity and quality of livestock feeds supplied in the country. This calls for seeking forages that complement poor quality feeds in the country. Hence, the target of this article was to compare three types of grass agronomic performance, yield, and chemical composition under three different agroecologies and three harvesting dates (60, 90, and 120 days). The field experiment was carried out in selected three districts in 2017/2018 in the main cropping season. The treatments were laid out in a factorial RCBD (the randomized complete block design) arrangement with three replications. The treatments contained the combinations of three altitudes and three harvesting dates. Agronomic, yield, and chemical composition data were collected from the current study and subjected to analysis of variance procedures with a $P < 0.05$ significance test. In most agronomical and chemical compositions, the interactions of altitudes and harvesting dates were significant for all tested grasses (Mulato II, Napier, and Rhodes grasses). The highest plant height (PH) and dry matter yield (DMY) by Napier and the number of tillers per plant (NTPP) by Mulato II were recorded. There were significant values ($P < 0.05$) for DMY and CP for all grasses at the interactions of harvesting dates and altitudes. The significant difference in DMY was observed as the harvesting date advanced, but CP was contrariwise. Of all tested species, the highest crude protein value and the least value of NDF and ADF (best forage quality parameters) were recorded by Mulato II. Thus, the results of this study revealed that *Brachiaria* hybrid cv. Mulato II has great potential to fulfil the demands for quality feeds for livestock production, especially at low altitudes. Nevertheless, in areas where, Napier and Rhodes grass are available, they can be alternative forage for Mulato II grass. Generally, for effective utilization of the tested grasses, the comparative feed value for animals must be conducted.

1. Introduction

Ethiopia has the largest livestock population among African countries [1] and the 10th largest in the world [2]. The function of livestock in the country ranges from livelihood for smallholder farmers to the contribution to the gross domestic product (GDP) of the nation. Nevertheless, livestock production and productivity per head of animal is very low because of various barriers such as a lack of good quality and adequate feed [3, 4] as well as fluctuating feed supplies with seasonal variation [5]. There is an enormous national food deficit (40% on a dry matter basis) that is increasing for essential nutrients (protein and energy) for livestock. The deficits in terms of dry matter, crude protein, and metabolizable energy are 40, 50, and 55%, respectively, at the national level [4]. This imbalance of dry matter and nutrients has led to lower livestock productivity while also increasing enteric methane emissions [6], which contributes to global warming in addition to reducing ruminant energy utilization. Thus, the production and use of better-quality forage species through appropriate selection can help to mitigate nutrient demand from livestock and reduce methane emissions from livestock.

The use of better-quality and climate-smart forage species is in receipt of significant acknowledgment as an option to overcome this problem in tropical areas [7], including Ethiopia [8–10] stated that if improved forages are combined and produced at the household level in a maintainable manner, livestock productivity will be improved. The use of such forages for herbivores especially ruminant animals not only provides required nutrients in adequate quantity but also reduces enteric methane emission. Moreover, the amalgamation of improved forage crops in agricultural systems has many benefits, including soil conservation and reduced weeds, pests, and diseases, in addition to their primary use as superior livestock feeds [11, 12]. One of the candidate forages is *Brachiaria* grass which is one of the diverse aspirant forages that have a multipurpose function in the farming systems of the tropics, including Ethiopia [13, 14].

Regarding the effects of such forages on animal productivity, recent try-outs reveal that the adoption of B. brizantha cultivars has great potential to increase milk yield from 3 to 5 liters per cow per day at farmers' conditions in Kenya by 15–40% [15] and up to 100% increase (an average of 36%) [16] and 20% meat output in Rwanda [17]. A controlled nourishing study in Rwanda by means of heifers revealed an upsurge in average body weight gain of 205 g per day over 12 weeks when practicing *Brachiaria* grass feeding compared with Napier grass [18, 19]. Similarly, an increase in meat production [20] was also achieved in Ethiopia. *Brachiaria* grass, especially Mulato II, has now become the most preferred grass among these farming communities in east Africa because of its high stages of drought and disease resistance combined with having high palatability and nutritional and considerable high biomass yield that increased productivity of animals [20]. Moreover, since the widely cultivated Napier grass, especially in the highlands, is threatened by stunt and smut diseases, which causes a total loss of the grass (100%) in severe cases [21, 22], Mulato II is being used as a climate-smart push-pull technology [23, 24]. Although *Brachiaria* is native to East Africa, including Ethiopia, this promising versatile cultivar Mulato II was recently reintroduced to Ethiopia after being out of the country for many decades. However, incomplete information exists on the agronomic performance, management practices, and chemical composition of this herb in Ethiopia in various agroecology. In addition, benchmarking the performance of related forage crops is one of the challenges in obtaining comprehensive information on the characterization of forage crops in the region. This study was therefore carried out to assess the agronomic performance and chemical composition of the *Brachiaria* hybrid VC. Mulato II comparatively with Napier and Rhodes grasses at different altitudes and harvesting dates in Ethiopia.

2. Materials and Methods

2.1. Description of the Experimental Sites. The study was conducted in three agroecologies (low, mid, and high altitude) in Ethiopia under the rain-fed system. The low altitude area is represented by Tach Gayint district situated at (110 22″N, 280 19″E) and at an altitude of 1230 m.a.s.l. The annual temperature of the area ranges from 13°C to 27°C and precipitation from 900 to 1000 mm. The midaltitude location was represented by a place called Woreta areas in Fogera District, which is situated at 11°58N and 37°41E at an altitude range of 1774 masl. The site's mean annual rainfall is 1216.3 mm and ranges from 1103 to 1336 mm. The highland area was represented by a place named "Melo" that is located near Debre Tabor Town at an altitude of 2650 masl [25]. The mean annual rainfall is about 1570 mm, and the mean maximum and minimum annual temperatures were reported to be 21.5 C and 9.6 C, respectively [26].

2.1.1. Land Preparation, Planting, and Experimental Design. The experiment was laid out in a factorial arrangement of three altitudes (low, mid, and high) and three harvesting stages (60, 90, and 120 days (d)) in a randomized complete block design with three replications. A total area of 341 m^2 for each site was selected from each of the three locations. The experimental land was ploughed in May and harrowed in June 2017. The experiment lasted from June 2017 to December 2017. The land was divided into three blocks, each of which comprised three plots (3 ∗ 3 m each). Planting materials of root splits (*Brachiaria* hybrid cv. Mulato II, Napier, and Rhodes (*Chloris gayana*)) were planted in rows on well-prepared soil. The spacing between rows and plants was 50 cm and 30 cm, respectively. Land preparation, planting, weeding, and harvesting were undertaken according to the recommendations for grasses in the study. Chemical fertilizers called diammonium phosphate (DAP) and urea were applied at a rate of 100 $kg{\cdot}ha^{-1}$ and urea at 25 $kg{\cdot}ha^{-1}$, respectively, during planting and after establishment based on the recommendations for the grasses.

2.2. Agronomic Data Collection. The agronomic data such as plant height (PH), leaf length (LL), tiller density (TD), number of leaves (NL) per plant, respectively, were recorded. Plant height and leaf length were measured from 10 plants that were randomly selected from the middle rows of each plot at 60, 90, and 120 d after planting at three locations. The tiller density and leaves were determined as mean counts taken from 10 plants that were randomly selected from the middle rows of each plot at specified harvesting dates from all sites. To determine biomass yield, the forage harvesting was carried out by the hand using a sickle, leaving a stubble height of 8 cm. A fresh herbage yield of the grasses was measured immediately after each harvest using a portable balance with a sensitivity of 0.01 g. Representative samples were taken at every plot at each site and were dried in a draft oven at 65°C for 72 h before being sent to the laboratory for chemical analysis.

2.3. Nutrient Content Analysis. The nutrient content of forage species was determined by taking representative samples from each plot and making a composite sample for each treatment. The dry matter content of samples was determined by drying the sample at 65°C for 72 hours then the samples were crushed to pass through a 1 mm sieve. Ash and/or organic matter (OM), dry matter (DM), crude protein, and total ash were measured by the procedures of

AOAC [27]. The neutral detergent fiber (NDF), acid detergent fiber (ADF), and acid detergent lignin (ADL) were determined according to the procedures of Van Soest and Robertson's technique [28]. The CP was calculated by multiplying the quantity of nitrogen in the sample by a factor of 6.25.

2.4. Data Analysis. Analysis of variance (ANOVA) was used to analyse data on agronomic factors and the nutritive value of samples using the model below. The SAS version 9.0 general linear model was used to analyse the data [29] (SAS, 2007). Tukey's test was used to separate treatment means when applicable, with $P = 0.05$ as the significance threshold.

For data analysis, the following statistical model was used:

$$Yijk = \mu + Ai + Hj + \mathrm{Ck} + Ai * Hj + A * C + H * C + A * C * H + \varepsilon ijk, \tag{1}$$

where: $Yijk$ is the response (plant morphological parameters, chemical composition, and yields) at each altitude and harvesting days; μ = overall mean; Ai = altitude (i = low, mid and high); Hj = effect of harvesting days (j = 60, 90, and 120 days); Ck = grasses (Mulato II, Napier, and Rhodes); $Ai * Hj$ = the interaction of the i^{th} altitude and j^{th} harvesting day; $A * H$ = interaction of altitude and harvesting age; $A * C$ = interaction of altitude and grasses; $H * C$ = interaction of harvesting age and grasses; $A * H * C$ = interaction of altitude, harvesting stages, and grasses; and εijk = the residual error.

3. Results

3.1. Comparison of Morphological Characteristics of Mulato II, Napier, and Rhodes Grasses across Altitudes and Harvesting Dates. Table 1 shows the effects of altitude and harvesting date on the plant morphological traits of Mulato II, Napier, and Rhodes grasses. Except for NTPP, Napier showed the largest significant differences ($P < 0.05$) in all morphological parameters at both low and high elevations, but at midaltitude, Napier only showed the highest significant differences ($P < 0.05$) in PH and NLPP. The interaction of latitude and harvesting date and three-way interaction factors (cultivar, harvesting date, and altitude) had a significant effect on morphological parameters such as PH, NTPP, and LLPP, except LLPP where it was nonsignificant for the interaction of altitude and harvesting date and three factors cultivar, altitude, and harvesting date.

Rhodes and cv. Mulato II had the largest significant difference ($P < 0.05$) in LLPP in midaltitude and NTPP in all altitudes, respectively. Furthermore, on each harvesting date, Napier grass on PH, NLPP, and LLPP and Mulato II on NTPP considerably recorded the highest value.

3.2. Nutritional Composition and the Yield Value of Mulato II, Napier, and Rhodes Grasses under Three Altitudes and Three Harvesting Dates. The mean values of *nutritional composition and the yield values* of Mulato II, Napier, and Rhodes. The interaction of factors had shown significant effect on almost all chemical composition of grasses including DM, DMY, ash, and CPY by Napier, CP by Mulato II, and the fibres (NDF, ADF, and ADL) by Rhodes were significantly ($P < 0.05$) recorded as the highest values in all altitudes. Regarding harvesting date, except for CP, there was a significant difference ($P < 0.05$) in all chemical composition and yield parameters. The highest values were recorded at the late stage of the harvesting date (120 d), except for CP at early and CPY midharvesting dates.

Regarding the interaction of different factors, except ADL, the interaction of each of the two and three factors had significant effect on the chemical composition of grasses. In terms of species, Rhodes grasses in every three agroecologies and the overall mean values of harvesting dates are presented in Table 2. Both altitude and harvesting dates had significant effects on the chemical composition and yield value of the grasses.

4. Discussion

The interaction of cultivar, altitude, and harvesting date affected nearly all of morphological parameters which imply that all factors have importance in determining the performance of grasses tested in the current study. The study also proved differences in morphological performance, nutrition, and productivity among the studied grasses in different agroecological conditions of Ethiopia. The overall results of Mulato II, Napier, and Rhodes in all altitudes showed that the highest height of PH and LLPP and the greatest number of NTPP and NLPP were documented for the last harvesting date (120 days) compared to both earlier and midharvesting stages (60 and 90 days). Alarming increments in plant height are one of the major acclimatization responses to light competition in plants, i.e., leaf length during the vegetative period in grasses [30]. Although height is not an exact approximation of estimated biomass yield, as the shortest Mulato II had a higher primary DM yield than Rhodes grass, an increase in plant height is affected by phenotypic plasticity. The high DM yield of Mulato II could be due to the high number of tillers which is associated to the grass's potential.

The leaf length result is contrary to reports for other species of grasses in which the leaf length was reported to decrease as a result of stem development at a later stage of harvesting [31] for grasses. Increments in plant height at later harvest stages could be due to massive root development and efficient nutrient uptake, allowing the plant to continue to increase in height [32]; the high DM yields of the cultivars can be attributed, among other factors, to a well-established root system that enabled the grass to extract growth resources from the soil [33, 34]. However, both Mulato II and Rhodes grasses gave significantly ($P < 0.05$) lower DMY than Napier grass in all altitudes. This might be related to the morphological characteristics of Napier which has thick steams and long leaves that might have contributed highest DMY in all sites. In related report, Napier grass has advantage in terms of growth

Table 1: Mean value of plant morphological characteristics (PH, NTPP, NLPP, and LLPP) values of Mulato II, Napier, and Rhodes grasses.

Varieties	Altitudes											
	Low				Mid				High			
	PH	NTPP	NLPP	LLPP	PH	NTPP	NLPP	LLPP	PH	NTPP	NLPP	LLPP
Mulato II	71.52^{c}	75.39^{a}	8.32^{b}	24.29^{c}	57.26^{c}	64.82^{a}	7.78^{b}	28.63^{b}	49.03^{c}	53.69^{a}	5.69^{b}	17.07^{c}
Napier	121.3^{a}	20.87^{c}	12.77^{a}	37.37^{a}	122.3^{a}	20.72^{c}	12.42^{a}	36.53^{a}	128.63^{a}	23.23^{c}	11.62^{a}	40.17^{a}
Rhodes	88.27^{b}	32.14^{b}	5.09^{c}	35.86^{b}	82.11^{b}	38.18^{b}	4.78^{c}	38.12^{a}	71.80^{b}	30.33^{b}	4.01^{c}	31.38^{b}
Sig	***	***	***	***	***	***	***	***	***	***	***	***
	Harvesting stages											
	60				90				120			
	PH	NTPP	NLPP	LLPP	PH	NTPP	NLPP	LLPP	PH	NTPP	NLPP	LLPP
Mulato II	40.67^{c}	46.46^{a}	6.11^{b}	19.76^{b}	58.78^{c}	64.37^{a}	7.86^{b}	23.69^{b}	78.37^{c}	83.08^{a}	7.82^{b}	26.55^{b}
Napier	105.86^{a}	16.83^{c}	10.16^{a}	37.38^{a}	120.0^{a}	22.40^{c}	10.24^{a}	38.00^{a}	146.38^{a}	25.59^{c}	16.08^{a}	38.69^{a}
Rhodes	74.47^{b}	24.63^{b}	3.94^{c}	29.80^{a}	81.81^{b}	30.92^{b}	4.52^{c}	37.28^{a}	85.90^{b}	45.10^{b}	5.41^{c}	38.28^{a}
Sig	***	***	***	***	***	***	***	***	***	***	***	***

		PH	NTPP	NLPP	LLPP
P value	Cv	***	***	***	***
	cv * al	***	***	***	***
	cv * hd	***	***	***	***
	al * hd	***	***	ns	*
	cv * al * ha		***	ns	***

Treatments means with different letters in a column are significantly different (***($P < 0.001$), **($P < 0.01$), *$P < 0.05$) for altitudes. SE=Standard error; PH = plant height; NTPP = number of tillers per plant; NLPP = number leafs per plant; LLPP = leaf length per plant; cv = cultivar; al = altitude; hd = harvesting dates.

Table 2: Mean value (%) of chemical composition and yield (DM, DMY, ASH, CP, CPY, NDF, ADF, and ADL) values of Mulato II, Napier, and Rhodes grasses.

Altitudes	Parameters								
	Varieties	DM (%)	DMY (t/ha)	ASH (%)	CP (%)	CPY (t/ha)	NDF (%)	ADF (%)	ADL (%)
Low	Mulato II	37.83^{b}	11.71^{b}	13.20^{b}	14.03^{a}	1.36^{b}	59.98^{c}	39.79^{c}	4.69^{b}
	Napier	38.77^{a}	31.57^{a}	15.37^{a}	12.59^{b}	4.48^{a}	65.95^{b}	44.44^{b}	5.35^{a}
	Rhodes	36.88^{c}	3.53^{c}	10.68^{c}	8.36^{c}	0.28^{c}	70.43^{a}	53.22^{a}	5.99^{a}
	Sig	***	***	***	***	***	***	***	**
Mid	Mulato II	36.93^{b}	10.38^{b}	12.89^{b}	12.20^{a}	1.32^{b}	61.98^{c}	38.31^{c}	5.52^{b}
	Napier	38.59^{a}	31.72^{a}	14.52^{a}	11.55^{b}	4.12^{a}	66.06^{b}	44.70^{b}	5.36^{b}
	Rhodes	35.09^{c}	3.40^{c}	8.95^{c}	6.68^{c}	0.21^{c}	72.20^{a}	50.99^{a}	6.65^{a}
	Sig	***	***	***	***	***	***	***	***
High	Mulato II	35.78^{b}	7.42^{b}	10.98^{b}	11.75^{a}	0.78^{b}	60.93^{b}	38.17^{b}	5.98^{b}
	Napier	38.25^{a}	31.77^{a}	13.16^{a}	5.85^{b}	2.38^{a}	71.92^{a}	52.18^{a}	5.65^{b}
	Rhodes	35.05^{b}	2.92^{c}	9.21^{c}	6.58^{b}	0.18^{c}	70.96^{a}	50.76^{a}	7.33^{a}
	Sig	***	***	***	***	***	***	***	***
HD	60	35.87^{c}	11.14^{c}	13.06^{a}	12.97^{a}	1.69	61.10^{b}	39.38^{c}	5.12^{c}
	90	36.87^{b}	15.76^{b}	11.53^{b}	9.61^{b}	1.72	69.13^{a}	47.08^{b}	5.71^{b}
	120	38.32^{a}	17.91^{a}	11.73^{b}	7.55^{c}	1.63	69.90^{a}	51.06^{a}	6.68^{a}
P value	Cv	***	***	***	***	***	***	***	***
	cv * al	***	*	*	**	**	***	***	*
	cv * hd	No	***	***	***	***	***	***	ns
	al * hd	ns	ns	ns	***	ns	***	***	ns
	cv * al * ha	ns	ns	**	***	***	**	***	ns

Treatments means with different letters in rows are significantly different (***($P < 0.001$); **($P < 0.01$); *($P < 0.05$) for altitudes; ns = nonsignificant; HDs = harvesting dates; DM = dry matter; DMY = dry matter yield; CP = crude protein; CPY = crude protein yield; NDF = neutral detergent fiber; ADF = acid detergent fiber; ADL = acid detergent lignin.

characteristics than other grasses, but the low nutritional value and is less preferred by animals compared to Mulato II [35]. Moreover, Rhodes grass, one of the cultivated pastures, has a narrow genetic base and limited ecological adaptation; it is a full-sun species that do not grow well under shade [36] and their establishment on acidic soils is also difficult [37]. These are some of the major reasons that Cv. Mulato II was introduced as an alternative to Napier grass and Rhodes grass, the predominant forage for dairy cattle in zero-grazing systems [38]. In addition, Napier grass is threatened by the emergence of stunt and smut diseases [39].

Mulato II had higher tiller numbers than Napier and Rhodes grasses at the interaction of harvesting dates and altitudes, but had lower DMY than Napier grass for the interactions, contradicting reports by [40] that tiller numbers are an indicator of resource use efficiency by different grass species and that the weight of a plant's tillers determines its productivity. However, Mulato II had higher tilling and dry matter production abilities than the Rhodes grass. The highest total DM yield observed in all altitudes by all studied grasses at the last harvest stage (120 d) was agreed with [41] for cultivated grasses [42] for natural pasture in Ethiopia. The increase in yield could be attributed to the development of more tillers, which increased leaf formation, leaf elongation, and stem development [28, 43]. All these physiognomies would contribute to increased photosynthetic activity and hence higher DM production.

With the advancing stage of development, a consistent decline in ash, CP, and CPY were observed, but on the contrary, NDF, ADF, and ADL were increased. The highest CP concentration was obtained at the earliest stage of harvesting, with values declining as harvesting was delayed. The decline of CP with increased cutting dates and intervals is attributed to the accumulation of fibres with time. Similarly, [44] reported a higher nutritive value of Mulato II when harvested at 2-week regrowth than at 6 weeks, and cutting Mulato II at 30-day intervals produced a CP level of 3–4% greater than the cutting interval of 45–60 days intervals, respectively. At the interaction of harvesting dates and altitudes the levels of CP of Mulato II exceeded the minimum of 7.0% suggested as necessary for the optimum rumen function by Van Soest [45]. But, the overall mean value of CP at the late harvesting date (5.06%) and the high altitude of Napier (5.85%) and also at mid (6.68%) and high altitudes (6.58%) of Rhodes did not fulfil the minimum of 7% suggested as necessary for the optimum rumen function. The interaction of harvesting dates and altitudes showed a higher CP content for Mulato II (14.03, 12.20, and 11.75%) compared with the mean values of Napier (12.59, 11.55, and 5.85%) and Rhodes grasses (8.36, 6.68, and 6.58%) at low, mid, and high altitudes, respectively. Similarly, the CP content of Mulato II was higher than 7–10% reported by [46] in the semiarid region of eastern Kenya [47] (2016) (5.3–7.7%) in the coastal lowlands of Kenya.

The trend in the NDF, ADF, and ADL content significantly increased ($P < 0.05$) with the advancement in maturity due to harvesting stages. This confirmed the results of similar studies by [48]. Rhodes grass had the highest ADF and NDF compared with Napier and Mulato II. Forage NDF is relevant to the improvement of the forage nutritional value and can be an important parameter to define the forage quality because the more fibrous pasture occupies more space for longer and limits the intake rate. For all locations used in the study, the values of NDF, ADF, and ADL were significantly ($P < 0.05$) higher during the third harvest (120). According to Schroeder [43], high NDF that is above 72% and 40% of ADF [44] will cause a low intake of forage. Mulato II has a lower than 72% NDF and the 40% ADF value during all stages of harvesting (59.97, 61.98, and 60.93% of NDF) and (38.17, 39.79, and 38.31% of ADF) at low, mid, and high altitudes, respectively. So, it has high intake by animals and produces a high milk yield and weight gain of animals since milk yield and/or weight gain are closely related to feeding intake [45]. This is true at all locations and harvesting stages. Inversely, the overall mean value of NDF and ADF indicated that Rhodes grass has low intake by animals at the mid (90 d) and late stages of harvesting (120 d), which are having greater than 72% of NDF (75.40 and 76.14%, respectively) and 40% of ADF. Forage with an ADF content of around 40% or more shows low intake and digestibility. In addition, the leaves of Napier grass also have a very rough surface, which is not preferred by the animals. This all suggests that the tested *Brachiaria* hybrid cv. Mulato II might offer more advantages in nutritional characteristics than Napier and Rhodes grasses at every harvesting date. This is also revealed by [49] that although chemical analyses of Mulato II grass and Napier grass have consistently ranked as similar in their nutritional qualities, a few feeding trials and farmers' perceptions have indicated that farmers preferred Mulato II to Napier grass. Farmers prefer Mulato II over Napier grass for several reasons: it is drought-tolerant, highly palatable and nutritious for livestock, easier to handle as cut-and-carry, and for making hay to be used during the dry season [50]. This is an indication that the palatability and response of animals improve could be improved when fed on *Brachiaria* grass [51]. Mulato with a forage legume during the dry season when Napier grass monocrops are disadvantageous due to drought, Napier stunt disease, and/or poor agronomic practices [38]. However, this is very limited in Ethiopia due to low awareness and research about grass [5, 24].

Regarding harvesting date, the intake of all the studied grasses is at a decreasing rate as they mature (significant increment of NDF, ADF, and ADL as the harvesting stage increases). The digestibility of foods is related to fibers because the indigestible portion has a proportion of ADF and ADL. *Brachiaria* has now become the most preferred grass among these farming communities in east Africa because of its high levels of drought and disease resistance coupled with palatable and nutritious biomass that increases milk production [15, 16] and meat production [13]. Generally, the recent study in the studied areas revealed that *Brachiaria* hybrid cv. Mulato II grass adapted well and had higher yield and nutritive values than other *Brachiaria* ecotypes [52], *Brachiaria* cultivars (Marandu and La Librtad) [53]. The significant difference among grasses in chemical composition due to interaction shows that the performances of grasses vary according to agro-ecologies and harvesting dates.

5. Conclusion

Most of the factors of agronomic, yield, and chemical composition of grasses tested vary in both altitudes and harvesting dates which shows that the factors have significant contribution in the determination of response variables. Of the tested grasses, *Brachiaria* hybrid cv. Mulato II was found to be the best cultivar for presenting high-crude protein production with the less fiber content and high biomass per hectare in this study. Particularly, in the low altitude, *Brachiaria* hybrid cv. Mulato II resulted in superior performance in all parameters, and this cultivar is therefore recommended for further demonstration at the low altitude in particular and in all study areas in general. Further agronomic and nutrition assessment studies involving live animal experiments are recommended to use this cultivar effectively.

Data Availability

All the data used to support the findings of this study are included within the article.

Disclosure

A preprint of the current article has been previously published [54].

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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