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Forage yield of *Urochloa* grass cv Camello I and II at different cutting frequencies and intensities

Godina-Rodríguez, Juan E.[1]; **Joaquín-Cancino, Santiago**[1*]; **Estrada-Drouaillet, Benigno**[1]; **Garay-Martínez, Jonathan R.**[2]; **Limas-Martínez, Andrés G.**[1]; **Bautista-Martínez, Yuridia**[3]

[1] Universidad Autónoma de Tamaulipas, Facultad de Ingeniería y Ciencias, Centro Universitario, Campus, Cd Victoria, Tamaulipas, México, C.P. 87149.
[2] Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias, Campo Experimental Las Huastecas, Carretera Tampico-Mante km 55, Altamira, Tamaulipas, México, C.P. 89610.
[3] Universidad Autónoma de Tamaulipas, Facultad de Medicina Veterinaria y Zootecnia, Campus, Cd. Victoria, Tamaulipas, México, C.P. 87274
* Correspondence: sjoaquín@docentes.uat.edu.mx

ABSTRACT

Objective: To evaluate the productive performance of forage from hybrid grasses of the genus *Urochloa* at different cutting intervals and intensities.

Design/Methodology/Approach: The cultivars Camello I (GPB025) and Camello II (GPB07) were evaluated at different intervals (5 and 7 weeks) and cutting intensities (10 and 20 cm). The research was carried out under seasonal conditions, from 2020 to 2021. The experimental design was a randomized complete block. The following variables were evaluated: yield of total dry matter (TDM), leaf (DMl), stem (DMs), inflorescence (DMin), and senescent matter (DMsm); as well as plant height, basal cover, specific leaf area (SLA), and leaf area index (LAI). DMI, DMs, DMin, and DMsm are the morphological components of the TDM.

Results: On average, harvesting the forage at a 7-week interval and with a 20-cm intensity results in higher TDM, DMl, and DMs (66, 46, and 85%, respectively) than those obtained when harvesting is carried out at a 5-week interval and with a 20-cm intensity.

Study Limitations/Implications: Agronomic management of grasses is a factor that affects forage yield and sward persistence. Cutting grasses at different intervals and intensities generates adequate management strategies aimed to increase yields and sward persistence.

Findings/Conclusions: The highest yield of total dry matter in both cultivars —according to their morphological component, plant height, and leaf area index— was obtained when the residual forage was harvested at a 7-week interval and a 20-cm height.

Keywords: Forage yield, hybrid grasses, cultivars (GPB025) and (GPB07), cutting interval and intensity.

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INTRODUCTION

Forage grasses are the basis of ruminant feeding in different livestock production systems. However, they have been classified as a poorly available food source, mainly in tropical and subtropical regions, given the edaphoclimatic conditions of those regions (Maldonado-Peralta *et al.*, 2019; Núñez-Torres and Rodríguez-Barros, 2019). Inadequate forage species

have been selected and established in areas for which they are not suitable. However, the forage yield of grasses largely depends on factors such as the genotype and agronomic management (Gándara *et al*., 2017). The agronomic management includes the intensity and frequency of defoliation, which are factors that modify the forage yield (Hernández *et al*., 2012; Rojas-García *et al*., 2018). When Cruz *et al.* (2017) evaluated Chetumal grass (*Brachiaria humidicola*) at different intervals (21 and 28 days) and grazing intensities (severe: 9-11 and light: 13-15 cm), they obtained greater forage accumulation when light grazing took place every 28 days (9,771 kg DM ha^{-1}) than with severe grazing (8,337 kg DM ha^{-1}). In cultivar Mulato II (*Urochloa* hybrid) grass evaluated at different intervals (21 and 28 days) and residual grazing intensities or heights (severe: 17-20 and light: 22-25), Cruz-Sánchez *et al.* (2018) determined that the forage accumulation obtained when grazing took place every 28 days was higher with light grazing (11,504 kg DM ha^{-1}) than with severe grazing (9,775 kg DM ha^{-1}). In this sense, in order to establish new grass cultivars, previous studies must be carried out to evaluate their productive performance, just as in the case of the grasses evaluated in this research, of which there is scarce information. Therefore, the objective of this research was to evaluate the forage yield of hybrid grasses of the genus *Urochloa* cultivars Camello I (GPB025) and Camello II (GPB07), at different cutting intervals and intensities.

MATERIALS AND METHODS

Study site location

The research was carried out from 2020 to 2021, at the "Posta Zootécnica Ingeniero Herminio García González" of the Facultad de Ingeniería y Ciencias, Universidad Autónoma de Tamaulipas, located at 23° 56' 26.5" N and 99° 05' 59.9" W, at 193 m.a.s.l. (INEGI, 2015).

Edaphoclimatic characteristics

The experimental site has a semi-arid warm climate, classified as BS_1(h') hw (Vargas *et al*., 2007). The average annual temperature and precipitation are 24 °C and 940 mm, respectively (SMN, 2010); the maximum and minimum temperatures were recorded during the evaluation period, along with the monthly accumulated precipitation (Table 1).

The soil is classified as clayey, with an alkaline pH of 8.3 (Garay-Martínez *et al*., 2018), for this, a soil analysis was carried out to determine the content of organic matter (OM), nitrogen (N), phosphorus (P), potassium (K), iron (FE) and zinc (Zn) (Table 2). Fertilization was not applied.

Plant material, treatments, and agronomic management

Urochloa hybrids [cultivars Camello I (GPB025) and Camello II (GPB07)] were used. The treatments were the combination of both cultivars at 5- and 7-week intervals and 10- and 20-cm cutting intensities. Swards sown in 2017 with a manual seeder at a distance of 15 cm between plants were evaluated. Prior to the evaluation, a uniformity cutting was made depending on the cutting intensity. Subsequently, the forage contained within 1 m^2 was harvested every 5 and 7 weeks with 10- and 20-cm intensities.

Table 1. Monthly accumulated temperature and precipitation during the evaluation period, in Güémez, Tamaulipas, Mexico.

	Maximum Temperature	Minimum Temperature	Rainfall
2020	**(°C)**	**(°C)**	**(mm)**
May	34	22	115
June	36	22	90
July	38	23	66
August	37	22	80
September	34	20	164
Octuber	34	16	77
November	30	14	18
2021	**(°C)**	**(°C)**	**(mm)**
March	38	14	22
April	32	19	49
May	35	21	105
June	35	22	87
July	36	21	57
August	39	22	79

Table 2. Chemical and physical characteristics of the soil of the experimental site.

pH	TN	OM	TCa	P	K	Fe	Zn	Sand	Slime	Clay	SAR
	%			mg kg $^{-1}$				%			
8.2	0.27	4.5	45.3	0.93	0.71	2.82	0.26	4.8	32.7	62.5	0.72

TN: Total Nitrogen; OM: Organic matter; TCa: Total carbonates; P: phosphorus; K: Potassium; Fe: iron; Zn: zinc; SAR: sodium adsorption ratio.

Evaluated variables

Plant height and basal cover

Three readings were made with a graduated wooden rule to obtain the average height at each cutting intensity within each experimental unit (1 m^2), measuring the height (cm) from the soil surface to the most homogeneous point of the leaves' apex. The coverage was estimated with a 1 m^2 steel frame, divided in 100 cm^2 grids; the frame was placed in the experimental unit (1 m^2) and the empty spaces were counted to subsequently estimate the coverage.

Yield of total dry matter and of each morphological component

The forage of each 1 m^2 experimental unit was harvested and immediately weighed to determine the yield of green forage (GF). Later, 300 g of sample were selected and separated into their morphological components: leaf (leaf blade + pod), stem, and dead matter (leaf blades with more than 50% chlorotic tissue). To estimate the leaf area, 10 leaf blades were taken from 5 stems per sample and measured with the Cl 202 Leaf Area Meter (CID Bio-Science® Inc., USA). All samples were dried in an OMS60 forced air stove (Thermo

Scientific®, USA) at 60 °C until constant weight was obtained. Each morphological component was weighed before (GF) and after (DM) drying on a CQT 2601 analytical balance (ADAM®, USA) to determine the percentage content of dry matter.

Specific Leaf Area (SLA) and Leaf Area Index (LAI)

The specific leaf area ($cm^2\ g^{-1}$) was estimated dividing the leaf area by its dry weight. To estimate the leaf area index, the total leaf area was divided by the ground-level surface (1 m^2, in the case of this research).

Statistical analysis

The variables were analyzed with the GLM procedure (SAS, 2003), with a randomized complete block design, and the Tukey test was applied for the comparison of means ($P=0.05$).

RESULTS AND DISCUSSION

Dry matter accumulation and morphological composition

The interval and intensity of defoliation had a significant effect ($P>0.05$) on the accumulation of total dry matter (TDM) and the dry matter of its individual morphological components. Regardless of the cultivar and cutting intensity, the highest TDM accumulation ($P>0.05$) was obtained when the forage was harvested at 7-week intervals. Several researchers (Cruz-Sánchez *et al.*, 2018; Cruz-Hernández *et al.*, 2020) have determined this performance prolonging the cutting interval of the longer regrowth period it provides to the sward. In this regard, decreasing the cutting intensity (from 11-15 to 13-15 cm) and increasing the cutting interval (from 21 to 28 days), Cruz *et al.* (2017) obtained a higher dry matter accumulation of the cultivar Chetumal (*Brachiaria humidicola*), with a light harvesting (13-15 cm) at a 28-day interval. The accumulation was 16 % higher than that obtained with a severe harvesting (9-11 cm). In this sense, Cruz-Sánchez *et al.* (2018) obtained a greater accumulation of annual dry matter of Mulato II at different grazing intensities (severe: 17-20 cm and light: 22-25 cm) and intervals (21 and 28 days), with a light grazing every 28 days. The greater forage accumulation obtained with a lower intensity harvest can be attributed to the residual leaf area in the sward after the forage is harvested: a greater leaf area results in an increase of the photosynthetic rate, which favors the increase in regrowth speed (Difante *et al.*, 2011). In this sense, no significant statistical difference ($P>0.05$) was recorded between cultivars and cutting intensities in the seventh week for TDM, DMl, DMs, and DMin; however, cultivar Camello II obtained 14 and 13% more TDM yield than cultivar Camello I with 10 and 20 cm intensities, respectively.

Regarding leaf yield, the cultivar Camello II obtained 21 and 15% more leaf yield when it was harvested at a 7-week interval, with 10- and 20-cm intensities, respectively, (Table 3). The stem yield showed a similar performance, obtaining the highest accumulation at a 7-week interval ($P<0.05$). In this case, the cultivar Camello II accumulated 10 and 17% more stem at 10 and 20-cm intensities, respectively. Regarding the DMsm yield, no significant statistical differences ($P>0.05$) were recorded between cultivars, intervals, and cutting intensities.

Table 3. Productive performance of *Urochloa* hybrids at different cutting intervals and intensities, in Güémez, Tamaulipas, Mexico.

Cultivar	Interval (weeks)	Intensity (cm)	DMI	DMs	DMin	DMsm	TDM
			kg DM ha^{-1}				
Camello I	5	10	388 c	21 b	38 c	12 a	461 c
Camello II		10	473 c	36 b	48 c	19 a	576 c
Camello I		20	529 c	33 b	68 c	14 a	644 bc
Camello II		20	655 bc	48 b	52 c	28 a	785 bc
Camello I	7	10	727 bc	218 a	188 a	15 a	1149 ab
Camello II		10	917 ab	240 a	151 ab	22 a	1331 a
Camello I		20	985 ab	218 a	225 a	18 a	1447 a
Camello II		20	1150 a	262 a	207 a	37 a	1657 a

DMI: leaf dry matter; DMs: stem dry matter; DMin: inflorescence dry matter; DMsm: dry matter of the senescent matter; TDM: total dry matter; different lowercase letters (a, b, c) in each column indicate a statistical difference (Tukey, P=0.05).

The greatest leaf accumulation is obtained with a light defoliation. In this sense, Rojas-García *et al.* (2018) recorded greater leaf accumulation in the cultivar Cobra (*Brachiaria* hybrid) harvested at 35 days with a 15-cm intensity (1,200 kg DM ha^{-1}) than with a 10-cm intensity (980 kg DM ha^{-1}). Similarly, when Torres *et al.* (2020) evaluated the cultivar Cobra at different grazing intensities (light: 15 cm and severe: 10 cm) at a 35-day grazing interval, they recorded greater leaf accumulation with a light grazing (5,323 kg DM ha^{-1}) than with a severe grazing (4,213 kg DM ha^{-1}); furthermore, stem accumulation was greater with a light grazing intensity (2,286 kg DM ha^{-1}) than with a severe grazing intensity (1,898 kg DM ha^{-1}). In this regard, Rojas-García *et al.* (2018) mention that the leaf content in the Cobra grass forage is more digestible and has a higher protein content than the stem.

Differences were detected ($P<0.05$) in the morphological and structural characteristics of *Urochloa* hybrids at different cutting intervals and intensities. The plant height variable ($P<0.05$) was affected by both the frequency and the intensity of cutting (Table 4). Regardless of the cultivar and cutting interval, the highest heights were obtained when the forage was harvested at a 20-cm height. In this sense, when they evaluated the effect of the cutting interval (14, 28, and 42 days) in two hybrids of the genus *Cynodon*, Silva *et al.* (2016) recorded higher plant heights when the forage was harvested at a longer interval (42 days). Regarding the specific leaf area, no significant statistical differences were registered ($P>0.05$); however, statistical differences ($P<0.05$) were observed between cutting intervals and intensities regarding the leaf area index variable —which indicates that the leaf area increases as the cutting interval is extended and the cutting intensity decreases. When they evaluated different hybrid cultivars of the genus *Urochloa* at 4, 6, and 8 weeks of regrowth, Garay *et al.* (2020) recorded a higher leaf area index for harvests with longer intervals (8 weeks); in this research, a similar performance was registered at 7 weeks. More leaves accumulated, when higher heights or longer cutting intervals are maintained in Mulato II grass; the improved production of those leaves increases the photosynthetic rate as well as the leaf area index (Yasuoka *et al.*, 2018).

Table 4. Morphological and structural characteristics of *Urochloa* hybrids at different cutting intervals and intensities, in Güémez, Tamaulipas, Mexico.

Cultivar	Interval (weeks)	Intensity (cm)	Plant height (cm)	Basal coberture (cm^2)	Specific leaf area ($cm^2\ g^{-1}$)	Leaf area index
Camello I	5	10	23 c	69 c	165 a	1.4 bcd
Camello II		10	24 c	68 c	152 a	1.3 bcd
Camello I		20	37 b	75 abc	146 a	1.2 cd
Camello II		20	37 b	78 ab	154 a	1.1 d
Camello I	7	10	37 b	71 bc	170 a	2.1 a
Camello II		10	39 ab	70 bc	160 a	1.8 ab
Camello I		20	50 a	72 bc	146 a	2.0 a
Camello II		20	51 a	83 a	163 a	1.7 abc

Different lowercase letters (a, b, c, d) in each column indicate a statistical difference (Tukey, P=0.05).

Regarding basal cover, statistical differences were registered ($P<0.05$). A lower basal cover was recorded for harvests with shorter intervals (5 weeks) and greater intensity (10 cm). This phenomenon represents a greater degradation of the meadow over time, another response to the current environmental conditions (Euclides *et al*., 2019).

CONCLUSIONS

The highest yield of total dry matter in both cultivars determined based on morphological component, plant height and leaf area index was obtained for harvests with 7-week intervals and a 20-cm high residual forage.

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