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RESPONSE TO DEFOLIATION INTENSITY ON THE PRODUCTIVE AND NUTRITIONAL INDICATORS OF *UROCHLOA* HYBRID CV. MAVUNO IN JALISCO, MEXICO

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ABSTRACT

The genus *Urochloa* is characterized by its high dry matter production, adaptation to infertile soils and droughts. The aim of this study was to determine the response to different defoliation intensities of the Mavuno grass hybrid on the dry season. The research was conducted in an experimental area in Gomez Farias, Jalisco, from January 2024 until April 2024. The experimental design was completely randomized in a 4 × 3 factorial arrangement, with four regrowth ages 30, 45, 60 and 90 days (d) and three defoliation intensities (5, 10, and 15 cm) with three replications. The yields of green forage and dry matter (DM), plant height, crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), acid detergent lignin (ADL), ether extract (EE), ash, organic matter (OM), metabolizable energy (ME) and *in situ* dry matter digestibility (ISDMD) were determined. The yields of green forage and DM were affected by defoliation intensity and maturity stage ($p \leq 0.01$). At 10 cm × 30 d of regrowth interaction a high CP (16.57 %) and low ADL (3.44 %) were found ($p \leq 0.01$), while lower values of NDF (43.08 %), ADF (18.92 %), and high ME (2.57 Mcal·kg^{-1}) were found at 45 d ($p \leq 0.01$). The highest ISDMD values were shown at 10 cm of defoliation intensity ($p \leq 0.01$), in interaction with 45 d and followed by 30 d of regrowth. It is concluded that a defoliation intensity of 10 cm with maturity stage of 45 d optimizes utilization of Mavuno grass hybrid by ruminants in dry season in the southern region of Jalisco.
Additional keywords: Digestibility, drought, nutritional quality, residual height

RESUMEN

Intensidad de la defoliación en los indicadores de producción y nutrición del híbrido *Urochloa* cv. Mavuno de Jalisco, México

El género *Urochloa* se caracteriza por una alta producción de materia seca y su adaptación a suelos infértiles y sequías. Se determinó la respuesta del híbrido de pasto Mavuno (*Urochloa* spp.) a diferentes intensidades de defoliación durante la época seca. La investigación se realizó en un área experimental establecida en Gómez Farías, Jalisco, de enero a abril de 2024. El diseño experimental fue completamente al azar, distribuido en un arreglo factorial 4 × 3, con cuatro edades de rebrote de 30, 45, 60 y 90 días (d) y tres intensidades de defoliación (5, 10 y 15 cm) con tres réplicas. Se cuantificaron los rendimientos de forraje verde y materia seca (MS), altura de la planta, proteína cruda (PC), fibra detergente neutro (FDN), fibra detergente ácido (FDA), lignina detergente ácido (LDA), extracto etéreo (EE), cenizas, materia orgánica (MO), energía metabolizable (EM) y digestibilidad *in situ* de la materia seca (DISMS). El rendimiento de forraje verde y la MS fueron afectados por la intensidad de la defoliación y el estado de madurez ($p \leq 0,01$). La interacción de 10 cm × 30 d de rebrote mostró una alta PC (16,57 %) y una LDA baja (3,44 %) ($p \leq 0,01$), mientras que valores más bajos de FDN (43,08 %), FDA (18,92 %) y EM alta (2,57 Mcal·kg^{-1}) se encontraron a los 45 d ($p \leq 0,01$). Los valores más altos de DISMS se observaron con una intensidad de defoliación de 10 cm ($p \leq 0.01$), en interacción con 45 días de maduración, seguidos de 30 días de rebrote. Se concluye que una intensidad de defoliación de 10 cm con una madurez de 45 días optimiza el aprovechamiento del pasto híbrido Mavuno por los rumiantes en la época seca en la región sur de Jalisco.
Palabras clave adicionales. Altura residual, calidad nutricional, digestibilidad, sequía

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INTRODUCTION

In Mexico, induced or cultivated grasslands represent 9.8 % of the national territory (INEGI, 2017) and constitute an important source of forage for meat and milk producing ruminants in extensive livestock farming (Jurado *et al*., 2021). To maintain the grassland productivity over time, management must be carried out with specific agronomic methods according to the needs of each grass species (Merchant and Solano, 2016).

Grasslands are large expanses of land that function as a feed resource for ruminants through grazing. This is an important tool in countries with large areas of grasslands, but their productivity depends on livestock management and type, as well as climatic and soil conditions (Chávez *et al*., 2022), which modify the adaptation and productive potential of forage species. The nutritional value of grasses used in the tropics represents a limitation to achieve greater productivity due to their high cell wall content and low content of soluble nutrients, affecting digestibility. Proper grass management (fertilization, grazing time, regrowth periods, stocking rate, and rotation systems) helps these species achieve their full potential and improve forage production parameters (Rojas *et al*., 2018).

To optimize forage use it is essential to identify the appropriate harvest time, considering plant yield, quality, and persistence. These factors that influence forage accumulation can be altered by stocking rate, which is related to the level of defoliation intensity. It has been observed that light defoliation maintained for extended periods can reduce dry matter accumulation, while moderate to severe defoliation decreases the availability of photosynthetic products in the stems (Cruz *et al*., 2017).

Therefore, it is important to identify plant species that can adapt to different management and changing climatic conditions. The genus *Brachiaria* grass (*Urochloa)* of African origin, belonging to the Poaceae family, includes annual or perennial grasses with an erect shape, characterized by high dry matter production and adaptation to difficult climates such as acidic, infertile soils and periods of droughts, and represents a suitable alternative for livestock farmers (Olivera *et al*., 2006; Maass *et al*., 2015). The Mavuno grass hybrid, developed in 2013, is a cross between *Urochloa brizantha* and *Urochloa ruziziensis* and is marketed as embedded seeds, with high speed of regrowth, large and robust root system ensuring greater performance and excellent dry tolerance, providing a greater supply of fresh green mass and greater dry regrowth capacity (Silva *et al*., 2024). Mavuno has a higher plant height and a lower concentration of crude protein than Marandu grass, applying different defoliation intensities which can promote the accumulation of forage but reduce the concentration of crude protein (Rodrigues *et al*., 2021).

Therefore, this study aims to determine the effect of defoliation intensity levels on the regrowth, quality, production, and degradability of Mavuno grass hybrid (*Urochloa* spp) in the dry season, given these challenges the Mavuno grass hybrid has emerged as a promising forage resource due to its drought tolerance and regrowth capacity.

MATERIALS AND METHODS

The experiments were carried out during the dry season in southern Jalisco, from January 11, 2024, to April 11, 2024, at the Gómez Farías Research Complex of the University of Guadalajara, in Gómez Farías county, Jalisco, Mexico. It is located at coordinates 19°47′38″ N and 103°28′37″ W, at an elevation of 1,506 masl The county territory ranges in elevation from 1,500 to 2,420 meters above sea level and has a predominantly hilly slope ranging from 5 to 15 degrees. Most of the county has a semi-warm, semi-humid climate. The average annual temperature is 16.1 °C, and its average minimum and maximum temperatures range between 4.1 and 27.2 °C. The average annual rainfall is 1,174 mm (IIEG, 2022). To observe the effect of defoliation intensity at different regrowth ages on nutrient concentration and *in situ* dry matter digestibility (ISDMD) of Mavuno grass during the dry season in southern Jalisco, the following defoliation intensities levels were proposed: 5, 10, and 15 cm; and the following cutting ages: 30, 45, 60, and 90 days, no irrigation was applied.

The samples were collected by triplicate, each sample covered an area of 1 m^2 from three 5 x 5 m plots, each plot was assigned a different residual stubble length which were 5, 10, and 15 cm from the soil surface to the grass stem, at 30, 45, 60, and 90 d of regrowth post-homogenization cut. At the beginning of the experiment the Mavuno grass received a fertilization of 400 kg·ha^{-1} of urea. The soil type is predominantly Cambisol (young soils susceptible to erosion), followed by Regosol (sandy well-drained soil with good fertility) and Andosol (made up of volcanic minerals, with a great capacity to retain water) (IIEG, 2022). At each cutting interval, the height of the plant was measured from the soil surface to the highest point of the stem in 5 randomly selected plants from each m^2; after that gardening scissors were used to cut the plant material. Each sample was weighed to calculate the green forage yield per m^2, chopped and placed in paper bags. When obtaining the yield per m^2 it can be calculated by ha. The samples were transported to the Animal Nutrition Laboratory of the Centro Universitario del Sur of the University of Guadalajara (CUSUR-UDG).

Each sample was dried in an oven at 55 °C for 48 hours at each stage of its growth and dry matter (DM) was determined, then ground in a knife mill (Thomas Wiley®) with a 1 mm sieve for further analysis. The crude protein (CP) was determined by the Kjeldahl method, ether extract (EE) by the Soxhlet method, crude fiber (CF) by the Weende method, ash by muffle combustion at 550 °C and organic matter (OM) by difference, all using the technique described by the AOAC (2003). In the case of fiber fractions, the samples were sent to the Animal Nutrition and Food Quality Laboratory of the Faculty of Agronomy of the Autonomous University of Nuevo León, Mexico, where the neutral detergent fiber (NDF,%) and acid detergent fiber (ADF,%) were analyzed using an ANKOM$_{2000}$ fiber digester (ANKOM Technologies, Fairport, New York, USA); In turn, acid detergent lignin (ADL) was determined by solubilizing cellulose with sulfuric acid, following the procedures described by Van Soest *et al*. (1991).

In order to determine the ISDMD of the experimental materials, a steer provided with a permanent ruminal fistula was used. This steer was located at the Research Complex of the CUSUR-UDG, in the municipality of Gómez Farias, Jalisco, Mexico. The steer was fed alfalfa and concentrate (80:20 % ratio) *ad libitum* throughout the experimental period. The authors confirm that they followed the standards for the protection of animals used for scientific purposes, in accordance with the Mexican official norm of technical specifications for the production, care, and use of laboratory animals (NOM-062-ZOO-1999). To estimate the ISDMD, Polysilk bags 10 × 15 cm with a pore size of 52 ± 10 µm were used. These bags were dried in an oven at 55 ºC for 24 h, then cooled in a desiccator and weighed and identified. Each bag was filled with 5 g of the previously ground experimental plant materials. The bags were closed with rubber bands and then attached to a chain using nylon thread. Triplicate samples of each material were incubated in the rumen for 6, 12, 24, 48, and 72 h; control bags, without samples, were also placed at each incubation time. Rumen incubation began at 8:00 a.m., and bags were added sequentially, ensuring that all bags were removed at the same time. After incubation, the bags were washed with potable water until clean, dried at room temperature, and finally, dried in a forced-air oven at 55 °C for 48 h. The dry weight was then recorded, and finally, ISDMD was determined.

A completely randomized design with two factors (regrowth age and defoliation intensity) was used, and a Tukey test for mean comparison of the data was conducted, using a SPSS statistical analysis software (SPSS version 22.0).

RESULTS

The average monthly air temperature during the study varied from 9.0 °C in February to 30.6 °C in March. The registered accumulated rainfall for the experimental period was 33.3 mm.

Table 1 shows that the green forage yield (GFY, kg·ha^{-1}) and the dry matter yield (DMY, kg·ha^{-1}) showed a significant effect ($p \leq 0.01$) in relation with the regrowth and stubble height or defoliation intensity (DI) but the interaction between regrowth × DI did not show significant effect for these productive variables, the lowest GFY was obtained at 45 d regrowth × 15 cm of DI while the highest were found at 90 days regrowth × 5 cm of DI. Moreover, the production of DM yields was found at 30 d regrowth × 15 cm of DI while the highest were found at 90 d regrowth × 5 cm of DI.

Table 1. Green forage yield (GFY), dry matter yield (DMY) and plant height (cm) of Mavuno hybrid at different levels of defoliation intensity and regrowth stage in the dry season of southern Jalisco.

Regrowth stage (d)	Defoliation intensity (cm)	GFY ($kg \cdot ha^{-1}$)	DMY ($kg \cdot ha^{-1}$)	Plant height (cm)
30	5	2,670 cd	960 c	16.77 de
	10	1,900 d	880 c	22.37 abcde
	15	2,470 cd	840 c	32.38 a
45	5	3,330b cd	1,940 bcd	15.52 e
	10	2,030 d	1,000 c	19.35 cde
	15	1,800 d	1,100 c	30.77 ab
60	5	5,800 ab	2,570 ab	21.20 bcde
	10	4,700 abc	2,210 abc	18.90 cde
	15	2,730 cd	1,440 bc	27.71 abc
90	5	6,130 a	3,270 a	26.93 abcd
	10	3,970 abcd	1,910 bcd	16.45 de
	15	3,400 bcd	2,020 bcd	23.87 abcde
	SEM	0.05	0.03	2.08
Factors *p*-value	Regrowth stage (A)	0.00	0.00	0.70
	Defoliation intensity (B)	0.00	0.00	0.00
	A × B	0.07	0.21	0.00

SEM: Standard error of the mean. Within columns, different letters for regrowth stages and defoliation intensity show significant differences $p \leq 0.05$ (Tukey test).

Regarding to the plant height, the DI and the regrowth × DI interaction showed a significant effect ($p \leq 0.01$), the lowest plant height was obtained at 45 d × 5 cm of DI, while the highest plant height was found at 30 d × 15 cm of DI.

As shown in Table 2, the chemical composition and metabolizable energy of the Mavuno grass under different defoliation intensities and regrowth stage showed a significant difference in all the variables analysed due to the factors and their interaction, except for the percentage of DM, which did not show a significant difference to the DI ($p > 0.05$). The lowest DM values were obtained at the 30 d regrowth × 5 cm of DI, while the highest were found at the cut of 45 d regrowth × 15 cm of DI.

The highest results of CP were found in the interaction of 30 d ×10 cm of DI and 45 d ×10 cm of DI ($p \leq 0.01$). The lowest content acid detergent lignin (ADL) was found at a 30 d ×10 cm of DI, whereas the highest ADL content was found at a 90 d ×15 cm of DI ($p \leq 0.01$). On the other hand, the highest values of EE were found in the interaction of 90 d regrowth × 10 cm of DI, while the lowest were found at 5 cm of DI × 30 d regrowth. The ether extract (EE) in which no significant difference was found in the interaction of regrowth × DI ($p > 0.05$), the highest ME value was found in the interaction of 45 d × 10 cm ($p \leq 0.05$).

The ISDMD of Mavuno grass varied significantly with regrowth age and with the interaction between regrowth × DI ($p \leq 0.01$), but not with the defoliation intensity alone at 6, 12 and 24 h of incubation time (Table 3), except at 6 h of incubation time also showed significantly to DI ($p \leq 0.05$). 48 and 72 h of incubation time did not show significant effect due the factors or interaction. The 10 cm treatments showed higher ISDMD at 45 d of regrowth at 6, 12, 24 h of incubation time ($p \leq 0.01$).

DISCUSSION

Nowadays, there is a need to intensify production in terms of biomass production and nutritional quality. This is because the effects of the rainy and dry periods, and the age of pasture regrowth can determine the optimal regrowth age for animals to graze and obtain the best results (Núnez *et al*., 2022). In this study in the dry season of south of Jalisco, with a semi-warm and semi-humid climate, the dry matter yields differ from those reported by Herrera *et al*. (2018) in a dry tropical region, who reported higher yields of dry matter at 15 cm and 56 d of regrowth (2,550 DM kg·ha^{-1}), the differences could be attributed to supplementary irrigation used in *Brachiaria* hybrid cv. Cobra. Similar results were reported by Rodrigues *et al*. (2021) in Brazil, where at a lower stubble height, a greater accumulation of forage per hectare was found. Kaneko *et al*. (2021) reported the dry matter production of palisade grass (*Urochloa brizantha* (Hochst. ex A. Rich.) R.D Webster) is better adapted for higher and infrequent cutting intensities under temperate zone conditions in Japan. In the present study, intense (5 cm) and moderate (10 cm) levels of defoliation appeared to stimulate forage availability of Mavuno grass in the dry season. Regarding plant height, Mavuno grass showed consistent behaviour with that reported by Dutra *et al*. (2014), who argued that cutting heights between 20 and 30 cm contributed positively to increasing the average leaf size of Mulato I grass, although in this study as the stage of maturity progressed, the grass that was defoliated more intensely reached the highest plant height. Ferraro and Oesterheld (2002), argued that biomass production was not related to the intensity of defoliation, however, defoliated plants may exhibit compensatory growth in relation to the amount of defoliated biomass, which in the long term may not be beneficial for the plant.

Nevertheless, these finding the greatest influence on the quality of the grass is given by the maturity stage (Schnellmann *et al*., 2020). Similar results were reported by Dutra *et al*. (2014), in the dry matter content of Mulato grass I, where the interaction between the stubble residual heights and evaluation period was not significant (p>0.05).

Mavuno grass showed more CP content at 10 cm at early cut intervals of 30 and 45 d these results are similar to those reported by Herrera *et al*. (2018), in which the intensity of defoliation did significantly influence the protein content. In other hand, our results are different from those reported by Rodrigues *et al*. (2021), who observed in Mavuno and Marandu grass an increase of the level of CP at more residual stubble height, although with a greater occurrence of rainfall. According to López *et al*. (2024), at higher maturity stage the percentage of CP decreases, but the Mavuno grass maintains higher levels compared to *Brachiaria* hybrid Mulato I. In the present study, as expected, younger grass had a higher CP content in its leaf tissue, but the defoliation level of 10 cm increases the concentration of this nutrient. Possibly, the grass may concentrate more of this nutrient in its leaves, and not use it for growth as could occur at a defoliation level of 5 or to maintain the residual stubble as could occur at 15 cm. In according with Gemeda and Hassen, (2014), selecting perennial grasses with a higher CP content could help to mitigate methane in tropical grazing-based feeding systems, due the negative association of protein content with methane production.

Anis *et al*. (2016) reported lower NDF values at 5 cm of stubble height, while for ADF content similar results were reported, with a higher ADF content at 15 cm of DI. In the present study, neither NDF and ADF showed a stable upward increase in their content as the grass matured. This behaviour was reported by Reyes *et al*. (2022) for NDF, but contrasts with the increasing content for ADF in *Brachiaria decumbens*. These results are different from those reported by Reyes *et al*. (2022), where ADL concentration increased significantly after 60 days. In the present study, ADL did not show a linear increase as the maturity advances. Higher NDF and FDA results, and lower ADL results in Mulato I were reported by López *et al*. (2024), at 10 cm of DI. Overall, with discrepancies with other studies, the contents of NDF, ADF and lignin components of the cell wall are affected by the stage of maturity, mainly the LDA. High contents of these components at 30 d x 5 cm of ID may be a result of the response to the maximum intensity of defoliation in the present study due to compensatory growth (Ferraro and Oesterheld, 2002), the moderate level of defoliation allows the Mavuno grass to maintain NDF and ADF contents at optimal levels regardless of the dry season. The EE content can be related to metabolizable energy content, the highest ME (2.57 Mcal·kg^{-1}) value was found in the interaction of 45 d × 10 cm, which had the second highest EE content in this study; the tropical grasses with higher EE and ME content may be associated with a decrease in methane production (Gemeda and Hassen, 2014).

Table 2. Chemical composition (DM, %) and metabolizable energy content (ME, Mcal·kg^{-1}) of Mavuno hybrid at different levels of defoliation intensity and regrowth stage in the dry season of southern Jalisco.

Regrowth stage (d)	Defoliation intensity (cm)	DM (%)	OM (%)	Ash (%)	CP (%)	NDF (%)	ADF (%)	ADL (%)	EE (%)	ME (Mcal·kg^{-1})
30	5	34.82c	86.28 c	13.72b	15.19ab	50.91b	24.93a	4.23b	1.22d	2.44de
	10	45.48bc	85.68bc	14.32ab	16.5 a	45.50ef	20.47ed	3.44b	1.48bcd	2.49abcde
	15	35.18 c	86.95 ab	13.06 bc	11.96 cd	54.69 a	26.12 a	3.67b	1.24 cd	2.47 bcde
45	5	58.15 ab	85.98bc	14.03 ab	14.66 ab	45.07 ef	21.15 cd	4.36b	1.54 abcd	2.43 e
	10	49.34 abc	86.47ab	13.53 bc	16.10 a	43.08 f	18.92 e	3.55b	1.87 ab	2.57 a
	15	61.99 a	87.97 a	12.04 c	13.38 bc	48.59 bcd	22.53 bc	3.56b	1.56 abcd	2.57 a
60	5	44.52 bc	85.84bc	14.16 ab	12.49 cd	47.55 cde	21.83 bcd	4.31b	1.82 ab	2.51 abcd
	10	47.04 abc	86.79ab	13.22 bc	10.92 de	47.17 cde	21.80 bcd	3.94b	1.78 ab	2.54 ab
	15	52.47 ab	86.69ab	13.31 bc	12.08 cd	46.15 de	20.97cd	4.03b	1.73 ab	2.56 a
90	5	52.68 ab	84.45c	15.56 a	9.37ef	50.47 b	22.95 b	4.15b	1.70 abc	2.45 cde
	10	48.32 abc	85.42c	14.59 ab	8.73 e	47.49 cde	20.78 d	4.16b	1.99 a	2.54 ab
	15	59.40 ab	85.43c	14.58 ab	9.27 f	49.58 bc	22.83 b	5.57[a]	1.51 bcd	2.52 abcd
Factors	SEM	3.18	0.31	0.31	0.39	0.54	0.33	0.19	0.09	0.02
p-value	Regrowth stage (A)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Defoliation intensity (B)	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	A × B	0.02	0.03	0.03	0.00	0.00	0.00	0.00	0.25	0.02

DM, Dry matter; OM, Organic matter; CP, Crude protein; NDF, Neutral detergent fiber; ADF, Acid detergent fiber; ADL, Acid detergent lignin; EE, Ether extract; ME, Metabolizable energy. SEM: Standard error of the mean. Within columns, different letters for regrowth stages and defoliation intensity show significant differences $p \leq 0.05$ (Tukey test).

Table 3. *In situ* dry matter digestibility (ISDMD) of Mavuno hybrid at different levels of defoliation intensity, incubation time and regrowth stage in the dry season.

Regrowth stage (d)	Defoliation intensity (cm)	Incubation time (h)				
		6	12	24	48	72
30	5	26.99 bc	39.82 a	48.46 abc	53.06	57.60
	10	28.96 b	36.58 ab	52.05 ab	58.55	62.26
	15	21.78 c	28.09 c	39.15 d	54.66	56.46
45	5	27.80 bc	38.80 a	43.07 cd	50.25	61.28
	10	36.54 a	40.04 a	55.80 a	56.31	65.32
	15	26.68 bc	30.23 bc	43.34 cd	55.85	58.36
60	5	30.49 ab	37.64 ab	44.34 bcd	47.91	62.61
	10	27.32 bc	39.68 a	48.49 abc	56.27	63.56
	15	31.64 ab	32.93 abc	44.93 bcd	51.66	56.15
90	5	29.09 b	32.50 abc	47.41bc	49.27	58.47
	10	30.90 ab	38.82 a	50.14 abc	51.24	60.42
	15	29.52 b	32.63 abc	47.04 bc	53.84	54.33
	SEM	4.36	6.94	7.16	29.69	30.11
Factors *p*-value	Regrowth stage (A)	0.00	0.00	0.00	0.37	0.16
	Defoliation intensity (B)	0.02	0.14	0.67	0.98	0.74
	A × B	0.00	0.00	0.00	0.29	0.09

SEM: Standard error of the mean. Within columns, different letters for regrowth stages and defoliation intensity show significant differences $p \leq 0.05$ (Tukey test).

The ISDMD performance at 45 d × 10 cm of DI interaction in the present study could be associated with the lower NDF and FDA content, the second highest percentages of CP and EE, as well as the highest ME content which may be suitable for reducing the energy losses for ruminal, higher CP and energy content, with less cell wall content helps rumen microbiota to amino acid biosynthesis, and thus resulted in better nitrogen conversion by microorganisms (Wei *et al*., 2021). The higher ISDMD at 48 h found at 30 d, could be associated with the highest CP content and the lowest ADL and often the digestibility of forage could be attributed to the ADL content, confirming that moderate defoliation (10 cm) in young regrowth (30–45 days) minimizes indigestible components; in older plants, potentially digestible components in tillers decreases whereas physiological maturity advances (Coca *et al*., 2022).

In contrast with our results, Rodrigues *et al*. (2021) observed that *in vitro* digestibility of organic matter was not affected by stubble height. Studies on *Brachiaria humidicola* reported similar trends under water stress (Cruz *et al*., 2017), supporting our hypothesis that regrowth management and moderate grazing intensities is the key in drought conditions. In practice, this allows for the design of grazing rotations that balance forage quantity and quality.

CONCLUSIONS

The Mavuno grass hybrid showed the best nutritional quality and *in situ* dry matter digestibility at 45 d and 30 d of regrowth, with higher CP concentration and lower FDN and FDA contents, these results are not associating with the main productive yields (GFY and DM). Under the climate conditions submitted in this study, at 45 d regrowth with a moderate defoliation intensity of

10 cm, could be used as a criterion for the optimum moment to produce forage with optimal nutritive values in the dry season and serve as alternative options for livestock producers of south region of Jalisco, México. However, if it is not possible to provide 45 d of rest to this *Urochloa* grass hybrid, our results suggested to harvest at 30 d regrowth, to avoid the disadvantages that come with grass maturity. Further studies should include the frequency factor, to determinate th survival and health of Mavuno grass.

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