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Supplemented grazing in Jersey-Holstein cows on two farms in the middle tropics of Valle del Cauca, Colombia

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ABSTRACT

In Colombia, dairy production systems in the mid-altitude tropics rely on grazing and minimal concentrate supplementation. This approach is primarily driven by cost considerations and the need to avoid forage substitution with concentrates. Using rotational grazing on star grass pastures (*Cynodon plectostachyus*) and supplementation with commercial concentrates, animal performance was monitored based on milk yield (liters-cow.day^{-1}) and daily dry matter intake (DMI.day^{-1}) in Jersey-Holstein (Jer-Hol) cows.

The study involved 15 cows per farm, with an average parity of 4 ± 2, at Finca Canadá (FC) (1,500 MASL) and Finca Chiquique (FCH) (980 MASL) in the Valle del Cauca region. Over nine weeks, the grazing behavior of the cows was observed every eight days for 24 hours. On average, across the two environments, cows spent 35.10% of the day grazing (CG), 31.10% ruminating (CR), 22.60% neither grazing nor ruminating (CNGNR), 1.75% drinking (CD), and 9.45% in milking (CM). Bite rate (BR) and chews per bolus (ChB) averaged 23 and 48 per minute, respectively, across both environments. The relative forage value (RFV) was low, at 85 and 82 for FC and FCH, respectively. Milk yield per cow was estimated at 18.00 and 14.80 kg cow.day^{-1}, with DMI at 15.50 and 13.70 kg cow.day^{-1}. These values reflect a biological efficiency of 1.16 and 1.08 liters of milk per kilogram of DMI for FC and FCH, respectively.

Keywords: rotational grazing, animal behavior, biological efficiency, milk production.

Pastoreo suplementado en vacas Jersey-Holstein en dos fincas del trópico medio del Valle del Cauca, Colombia

RESUMEN

En Colombia, los sistemas de producción lechera, en el trópico medio, dependen del pastoreo y suplementación con concentrado, en cantidad mínima, por costo y para no hacer sustitución de forraje por concentrado. Con base en pastoreo rotacional en pastizales de estrella *Cynodon plectostachyus* y suplemento de concentrado comercial, se monitoreó el comportamiento animal con base en la relación producción de leche (litros-vaca.día^{-1}) y la ingesta de materia seca por día (IMS.d^{-1}) en vacas Jersey-Holstein (Jer-Hol). Se utilizó vacas de 4 ± 2 partos, 15 vacas.finca^{-1}, en Finca Canadá (FC) (1.500 m s. n. m.) y Finca Chiquique (FCH) (980 m s. n. m.), en el Valle del Cauca respectivamente.

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Se observó durante 24 horas cada 8 días por 9 semanas el comportamiento en pastoreo y se determinó que, de las 24 horas del día en promedio, para los dos ambientes, las vacas pastaron (VP) 35,10%, rumiaron (VR) 31,10%, no pastorearon ni rumiaron (VNPNR) 22,60%, vacas bebiendo (VB) 1,75% y en ordeño (VO) 9,45% del día respectivamente. La toma de bocado (TB) y rumia por bolo (RB) en promedio para los dos ambientes fue 23 y 48 por minuto, respectivamente. El valor relativo del forraje (VRF) fue bajo, en 85 y 82 para FC y FCH, respectivamente. El desempeño lácteo por vaca se estimó en 18,00 y 14,80 kg vaca.día^{-1} y CMS de 15,50 y 13,70 kg. vaca.día^{-1}, ello supone una eficiencia biológica de 1,16 y 1,08 litros de leche por kilo en CMS para FC y FCH, respectivamente.
Palabras clave: pastoreo rotacional, comportamiento animal, eficiencia biológica, producción lechera.

INTRODUCTION

Dairy production systems in the mid-altitude tropics of Colombia (1,000 to 2,000 MASL) (Echezuría 2019) are characterized by low-quality pastures, which requires strategic supplementation with commercial concentrates. However, this supplementation is managed to avoid critical levels of forage substitution by concentrates (Morales & Ortiz 2018). Grazing behavior reflects voluntary intake in cows and serves as a primary indicator of biological performance, as it is closely associated with animal health and welfare (Werner *et al.* 2019; O'Leary *et al.* 2020; Horn & Isselstein 2022).

Voluntary intake regulation is influenced by several factors, including the social status of a cow within the herd, grazing expertise, hierarchical rank, breed, size, and the intrinsic value of the available fresh forage (AFF) under prevalent tropical environmental pressures (Tarazona *et al.* 2012; Salah 2022; Iqbal *et al.* 2023). For grazing animals, accurately estimating forage dry matter intake (kg cow^{-1} day^{-1}) is the most critical tool for milk production management (Rombach *et al.* 2019; Pinheiro & Gregorini 2022).

Climatic conditions and soil fertility significantly affect forage quality, creating either positive or negative synergies that alter the quantity and quality of AFF. These changes influence key parameters such as neutral detergent fiber (NDF), which affects intake, and acid detergent fiber (ADF), which governs digestibility, energy intake, and water and energy requirements (Lee *et al.* 2021; Iqbal *et al.* 2022; Iqbal *et al.* 2023).

Given these dynamics, field-based data collection was essential to understand the grazing behavior of F1 Jersey-Holstein (Jer-Hol) cows under tropical conditions. Based on this need, the objective of the study was to observe the grazing behavior of supplemented Jer-Hol cows and assess their biological and productive performance at two altitudes within the mid-altitude tropics of Valle del Cauca.

MATERIALS AND METHODS

Location

The fieldwork was conducted at Finca Canadá (FC) and Finca Chiquique (FCH), situated at two altitudes in Valle del Cauca, Colombia (table 1).

Biological material used

Fifteen Jersey-Holstein (Jer-Hol) cows grazed on *Cynodon plectostachyus* (star grass) pastures and were supplemented

TABLE 1. Location and environmental characteristics of the farms where Jer-Hol cows grazed

Descriptor	CF	CHF
Municipality	Restrepo	Yotoco
Geographic coordinates	N 03° 50, 723 W 076° 27, 899	N 03° 82, 984 W 076° 39, 108
Average annual temperature (ºC)	24	25
Relative humidity (%)	75	76
Annual precipitation (mm)	1,256	1,000
Altitude (MASL)	1,500	980
Average distance from the pastures to the milking parlor (m)	270-560	290-460
Average walking time to and from the milking parlor (min)	19.9	12.9

Where: CF= Canada Farm. CHF= Chiquique Farm.

Source: own elaboration.

with commercial concentrate. Starting from a baseline of 10 liters of milk per cow, one kilogram of concentrate was allocated for every additional 5 liters of milk produced. The cows were fitted with numbered collars corresponding to their parity (4 ± 2), monitored during the first 100 days of lactation, and observed grazing for 24 hours every eight days over a nine-week period (Suárez et al. 2014; Balochi et al. 2002; Iqbal et al. 2023).

Ethics committee approval

The research was approved by the Ethics Committee for Research at the Faculty of Agricultural Sciences, Palmira Campus, under certificate CEI-FCA-07/2024 issued on July 2, 2024.

Variables evaluated

The time allocation of the cows for various activities was measured on each farm, including grazing (CG), drinking water (CD), ruminating (CR), inactive behaviors such as resting or sleeping (non-grazing and non-ruminating, CNGNR), and milking (CM), which included walking and waiting in the milking parlor. Additionally, bite rate (BR), chews per bolus (ChB), and weekly milk production per cow (MP) were recorded (adapted from Suárez et al. 2014; Balocchi et al. 2002). Dry matter intake (DMI) was estimated using three mathematical models developed in the doctoral dissertation of Morales Vallecilla (2016).

Double Sampling Model (2M)

This model estimated the available fresh forage (AFF) before cow entry (24-hour grazing period) and the remaining forage (RF) after grazing. Samples were collected using a 0.25 m² quadrat frame, following the protocols described by Morales (2016):

$$\text{DMI 2M} = (\text{AFF} - \text{RF}) * \%\text{MS}$$

Mertens Model (1985)

(Mer): Dry matter intake (DMI) was linked to neutral detergent fiber (NDF) consumption, which ranged from 1.1% to 1.2% of the animal's live weight (LW). Mertens proposed a formula to precisely estimate DMI based on NDF concentration in the diet and the animal's live weight:

DMI Mer = (1,2% * LW) / (%NFD)

NRC 2001 Model (NRC)

This model predicted DMI based on fat-corrected milk (FCM), the animal's metabolic weight, and weeks in lactation (WIL):

The term adjusts for the decline in DMI during the early postpartum weeks.

FCM o LCG= 0,4 * (kg milk/day) + (15 * kg milk fat/day) where 0.4 and 15 are constants.

Microsoft Excel 2016 was used for data processing through univariate statistical analysis of field observations. For forage intake calculations, mathematical models from the literature were applied (Mertens, 1985; NRC, 2001).

RESULTS AND DISCUSSION

Biological characteristics of the pasture

During the experimental period, the pastures at FC and FCH exhibited high levels of neutral detergent fiber (NDF) and acid detergent fiber (ADF), along with moderate protein content (table 2). These values correspond to a fourth-category forage quality based on forage classification criteria (García et al., 2005; Ortiz and Valdés, 2019). The classification ranges from the highest quality level, characterized by protein >19%, ADF <31%, NDF <40%, and a relative forage value (RFV) >150, to the lowest (fifth category), defined by protein <8%, NDF >65%, ADF >45%, and RFV <75.

Forages represent a limiting factor in animal production as they contribute the majority of the NDF, which restricts intake, and the ADF, which determines the rate

TABLE 2. Composition and biological characteristics of the forage consumed by Jer-Hol cows

DESCRIPTOR	CF	CHF
ADF %	38.40	42.20
Lignin %	6.50	6.20
NDF %	61.60	66.00
EE %	1.58	1.05
CP %	14.40	15.61
DMD %	56.00	58.00
DMI %	1.90	1.80
RFV	85.00	82.00

Where: CF= Canada Farm. CHF=Chiquique Farm. ADF= Acid detergent fiber; NDF= Neutral detergent fiber; EE= Ethereal extract; CP= crude protein; DMD= dry matter digestibility; DMI= Dry matter intake live weight %; RFV= Relative feed Value.

Source: own elaboration.

of ruminal degradation of forage material (Ortiz & Valdés 2019; Lee *et al.* 2021).

Time spent on daily activities by cows grazing

At FC, the cows spent 34.40% of their daily time (496 min/day) grazing to collect forage directly, while at FCH, they spent 19 minutes more than at FC (table 3). The average grazing time observed across both locations was 35.10% of the daily time (505 min/day). This value falls within the range reported in other studies, such as Balocchi *et al.* (2002) and Rombach *et al.* (2019), who documented grazing times between 32.20% and 38.30% of the day (464 to 552 min/day) under similar conditions.

Furthermore, using Global Positioning System (GPS) collars, it is estimated that adult cows may graze for 33% to 42% of the day (Augustine & Derner 2013). Grazing time is influenced by several factors, including the level of fasting prior to grazing. The production status of each cow affects its foraging dynamics and voracity (Werner *et al.* 2019).

Cows typically enter the pasture energetically after milking and sustain their consumption cadence for two to four hours, after which intake progressively declines. This observation aligns with findings by Sheahan *et al.* (2013), who reported that 94% of cows grazed for one hour following the morning milking. After this period, grazing gradually decreased to 35% over the subsequent four hours.

The grazing level and the time spent grazing are closely related to the availability and quality of the fresh forage dry matter (AFF) offered, which was higher at FC (0.541 kg AFF/m²) compared to FCH (0.384 kg/m²). This relationship indicates that grazing time increases as forage availability decreases, as limited forage availability constrains the cow's ability to efficiently graze the pasture (García *et al.* 2005; Lee et al. 2021). Ultimately, grazing time is mechanically influenced by pasture quality,

TABLE 3. Average time distribution and confidence intervals for activities performed by Jer-Hol cows on grazing land

Activity	CG	CR	CNGNR	CD	CM
			CANADA FARM		
Minutes/Day	496	474	306	24	140
CV %	4.50	2.87	4.36	8.38	7.14
CI	444-547	443-506	275-336	20-29	117-163
			CHIQUIQUE FARM		
Minutes/Day	515	422	344	26	133
CV %	2.77	6.99	8.30	16.50	6.61
CI	482-548	354-490	278-409	16-36	113-154

Where CG= Cows grazing, CR= Cows ruminating, CNGNR= Non-grazing cows do not ruminate and include periods that the animal uses to vegetate and sleep; CD= cows drinking; CM=cows being milked, including the walk to the milking parlor and waiting; CV=Coefficient of variation; CI= Confidence interval.

Source: own elaboration.

as more mature forage exhibits higher levels of neutral detergent fiber (NDF) (table 2), which correlates with reduced intake. This was observed at FCH (table 5), whereas at FC, higher AFF intake was achieved. In our study, early rumen fill at FC was influenced by both NDF content and forage substitution levels, alongside forage availability. As a result, cows spent less time grazing at FC compared to FCH (Zhao & Jurdak, 2016; Burns & Sollenberger, 2002; Reategui *et al.* 2019).

At FC, the cows consumed 4.50 kg of concentrate per cow per day, which was 26.67% more dry matter (DM) than FCH, where cows consumed 2.70 kg of concentrate per cow per day along with 0.60 kg of silage per cow per day (table 5). This likely contributed to a reduction in grazing time, as forage was substituted with concentrate and silage. The substitution effect reduced grazing time by up to 12 minutes per day for each kilogram of dry matter supplement consumed (Bargo *et al.* 2003; Russo *et al.* 2021).

Ruminating

At FC, cows spent 32.9% of their daily time ruminating (474 min/day), which was 52 minutes more than at FCH (table 3). This can be logically explained: cows with a full rumen, as observed at FC, must allocate more time to the mechanical digestion of the bolus (rumination). Daily rumination is influenced by the quality and quantity of feed consumed, which was clearly of lower quality at FCH (Sjaastad *et al.*, 2010; Russo *et al.*, 2021).

The extended rumination time at FC was likely due to reduced mechanical resistance to forage breakdown compared to FCH. The literature indicates that the resistance to particle size reduction during chewing is directly proportional to the NDF content of the feed; lower NDF content corresponds to lower mechanical resistance (table 2) (Romney & Gill 2000; Zhao & Jurdak 2016).

Non-grazing and non-ruminating activities

At FC, cows spent 21.3% of their time resting or sleeping without engaging in grazing or rumination activities (306 min/day), which was 38 minutes less than at FCH (table 3). This reduction at FC resulted from the increased time allocated to rumination, thereby decreasing the time spent on non-grazing, non-ruminating activities (CNGNR). According to Pulido et al. (2001), cows with higher milk production tend to spend more time either ruminating or grazing, significantly reducing the time spent standing or lying idle.

Climatic factors directly influence livestock activities by affecting animal physiology (temperature, relative humidity, internal and external parasites) and indirectly by altering the growth and chemical composition of grass and forages (Pérez *et al.* 2008). These factors positively influenced the animals at FC, providing better comfort and nutritional conditions compared to FCH, which allowed for a more balanced allocation of time across different activities.

Overall, the daily time of the cows at both FC and FCH was primarily spent on grazing (CG), ruminating (CR), and CNGNR activities, collectively accounting for 88.8% of the total time. Within this proportion, 22.6% (325 min/day) was dedicated to CNGNR. This finding is consistent with Balocchi *et al.* (2002), who reported that these three activities represented 87.7% of daily time, with 24.2% dedicated to CNGNR.

Drinking activity

The time spent drinking was similar at FC (1.7%) and FCH (1.8%) of the daily time budget (24 and 26 min/day, respectively). However, these values contrast with the 0.5% (7 min/day) reported by Balocchi et al. (2002). This discrepancy is likely due to the tendency of Bos taurus cattle to consume more water in hot climates (Patiño et al. 2008; Bernabucci *et al.* 2010). The average annual temperatures at FC and FCH were 24 °C and 25 °C, respectively, compared to the 12 °C reported in Balocchi et al. study. As ambient temperature increases, water consumption also rises (Molina et al. 2016).

Milking activity

Milking time was similar at both FC and FCH, accounting for 9.7% and 9.2% of the daily time budget, respectively (140 and 133 min/day). The average distance from pastures to the milking parlor ranged between 270-560 m at FC and 290-460 m at FCH, with both farms using the same mechanical milking system. The values observed in this study align with the literature, where Balocchi et al. (2002) and Pulido et al. (2001) reported milking times of approximately 10% of daily time under similar conditions. In another study, Clavijo (2018) found that milking took 120 min/day without

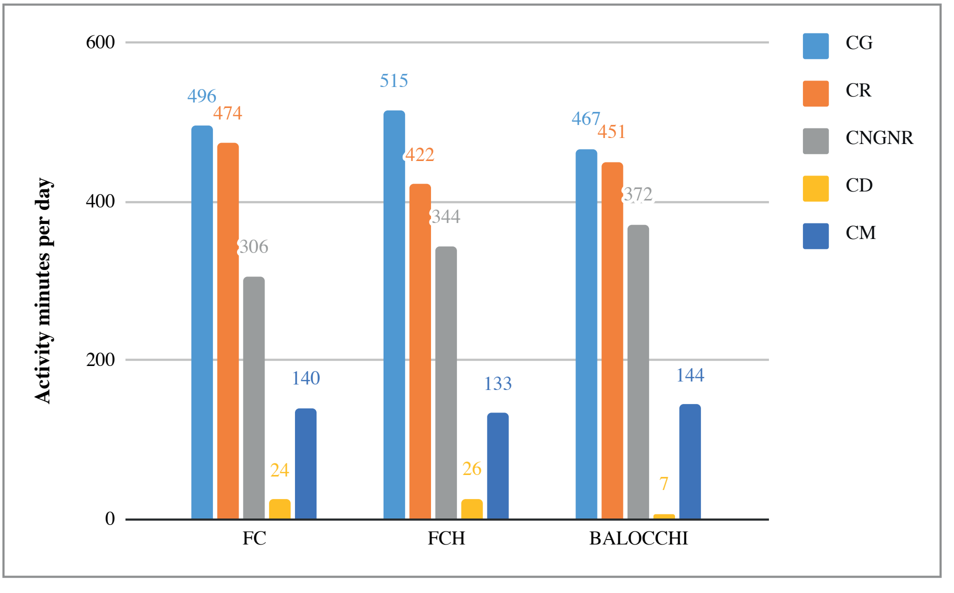

FIGURE 1. Comparison between the daily time dedicated to each activity for cows FC (Canada Farm), FCH (Chiquique farm) and Balocchi.

Where: CG: Cows grazing, CR: Cows ruminating, CNGNR: Non-grazing cows do not ruminate and include periods that the animal uses to vegetate and sleep, CD: Cows drinking and CM=Cows being milked, including the walk to the milking parlor and waiting. Balocchi *et al.* 2002.

Source: own elaboration.

accounting for the time spent walking to the milking parlor.

Figure 1 summarizes the daily time spent on each activity at FC and FCH and compares it with the study by Balocchi *et al.* (2002). A similar pattern is observed, except for drinking activity (CD).

Bite rate (BR, bites min^{-1}):

The bite rate pattern of Jer-Hol cows at FC and FCH showed the highest activity immediately after milking, averaging 24 ± 2 and 21 ± 2 bites min^{-1}, respectively (table 4). These values are lower than the minimum reported in the literature, where BR ranges from 30 to 50 bites min^{-1}. Such rates appear to be common in both cattle and sheep, with total daily bites for adult cattle ranging between 12,000 and 36,000 (Vallentine 2001). BR values in dairy cows under grazing conditions in cold climates range from 45.7 to 55.3 bites min^{-1} (Pulido et al. 2001). Similarly, positive effects on BR have been observed in both heifers and adult cows, with rates of 59 to 60 bites min^{-1} reported in subtropical climates (Abrahamse *et al.* 2008; Kondo 2011; Jiménez & Améndola 2022).

The lower BR observed in this study is likely influenced by forage quality and availability (table 2). At FCH, the star grass matured more rapidly than at FC. At FC, the relative forage value was likely higher due to lower neutral detergent fiber (NDF) content, which influences intake, and lower acid detergent fiber (ADF) content, which affects ruminal degradation. These conditions were likely more favorable at FC, supported by a more temperate climate, as similarly reported for Jersey cows grazing on alfalfa in the Mexican highlands (Lemus *et al.* 2020).

Forage characteristics and consumption dynamics

Forages with low cell wall content, specifically low neutral detergent fiber (NDF) and acid detergent fiber (ADF), are more palatable and digestible, particularly when derived from forage plants grown in favorable climatic conditions (García *et al.* 2005; Tarazona *et al.* 2012; Hernández *et al.* 2024).

The type of pasture (e.g., green forage) used for animal feeding in the subtropical climates of Argentina positively influences

TABLE 4. Average distribution of bite and chewing rate per regurgitated bolus in grazing Jer-Hol cows

DESCRIPTOR	CF	CHF
Average Bite Rate (BR)	24	21
Coefficient of variation %	3.79	5.07
Confidence Interval	22-26	19-23
Average Chews per Bolus (ChB)	49	47
Coefficient of variation %	1.51	2.29
Confidence Interval	48-51	44-49

Where: CF=Canada Farm. CHF=Chiquique Farm; BR= Bite Rate expressed in bites per minute; ChB= Chews per Bolus expressed in chews per minute.

Source: own elaboration.

bite rate (BR) without evident substitution effects from supplementation with 2–8 kg day^{-1} of concentrate. In such conditions, BR averages 58 bites min^{-1}, ranging from 45 to 78 bites min^{-1} when grazing on ryegrass (Bargo *et al.* 2003) or alfalfa in the Mexican highlands, promoting voracious pasture consumption (Tarazona *et al.* 2012).

For African star grass, forage intake increases with pasture height due to a strong correlation between height, availability, and quality. Cows harvest tender tops with greater bite mass (GBM, g DM bite^{-1}), enabling high intake rates (IR, g DM min^{-1}) (Treydte *et al.* 2009; Soares *et al.* 2021). However, BR decreases when cows encounter lush, tall materials exceeding withers height, such as hybrid Brachiaria (Mulato, Toledo) or Guinea grasses (Tanzania). These conditions are likely to reduce forage intake despite larger bites due to the increased difficulty of coarse mastication and swallowing (Treydte *et al.* 2009; Jiménez & Améndola 2022; Rodrigues *et al.* 2024).

The 10 cm height difference between the FC and FCH pastures did not affect BR but did influence dry matter (DM) intake and grazing time in FCH. The lower forage density and stem toughness of African star grass in FCH critically restricted forage consumption, reducing the harvested DM and requiring longer grazing periods. In contrast, younger star grass pastures encourage higher BR and longer grazing time until rumen fill is achieved (Jiménez & Améndola 2022).

Chewing activity and rumination behavior (ChB)

Regardless of the environment, cows walked to the pastures after waiting in the milking parlor, crouched, and engaged in vigorous grazing. Generally, cows spent two to four hours filling their rumen, after which the grazing rate decreased, and rumination began. Rumination occurred consistently whether cows were standing, lying, walking, urinating, or defecating.

The average number of chews per bolus (ruminations) per minute was 49 ± 2 in FC and 47 ± 2 in FCH, with no significant differences observed (table 4). The onset of rumination depends on the mechanical effect of coarse forage rubbing against the reticulorumen atrium, triggering regurgitation (Church 1993). This process occurs effectively only when the rumen is full and contains coarse forage (Van Soest 1994), typically following intense post-milking grazing.

Monitoring chewing cadence and rumination time serves as a useful tool to assess herd health (Paudyal 2021). Variations in forage quality and rumen retention time (degradation in the rumen) may explain observed differences in rumination patterns (Hernández *et al.* 2024).

Dry matter intake and its relationship with milk production

The mathematical models evaluated demonstrated varying levels of accuracy in predicting average dry matter intake (DMI) in kg DMI/day per animal. The models ranked from highest to lowest prediction accuracy as follows: the National Research Council 2001 (NRC) model, the double-sampling model (2M), and the Mertens model (Mer) (table 5).

The gross biological efficiency of milk production for FC and FCH, calculated using the average data for milk production and DMI (table 6), showed that two of the three evaluated models closely approximated the reference values reported in the literature for each farm. Specifically, the

NRC model yielded efficiencies of 1.16 and 1.08 kg of milk per kg of DMI, while the 2M model showed efficiencies of 1.22 and 1.12 kg of milk per kg of DMI. These values align with those reported by Bargo *et al.* (2003) and Hutjens (2005), who identified efficiencies of approximately 1.20 liters for grazing systems in high-altitude tropics and higher values, ranging from 1.40 to 1.50 liters, for confinement systems.

Biological efficiency in grazing systems is primarily influenced by the quality of pasture at the time of intake. It was evident that even a difference of 600 meters in altitude significantly affected forage supply, quality, and availability (Morales & Ortiz 2018).

Looking ahead, under the unpredictable pressures of climate change, the rapid development of innovative agricultural technologies offers significant potential to advance grazing management in the digital era. However, as Horn and Isselstein (2022) emphasized:

The rapid development of innovative agricultural technologies can improve and elevate grazing management to the next level in the digital era. However, no holistic system adequately integrates innovative technology into precision livestock grazing management and the precision monitoring of pastures in a system that can be used to monitor and manage all driving factors within the grazing system.

TABLE 5. Dry matter intake estimated by three prediction models for Jer-Hol cows in CF and CHF

DESCRIPTOR	CF			CHF		
	NRC	2M	Mer	NRC	2M	Mer
DMI Stargrass	-	10.2	8.9	-	9.9	7.5
DMI Concentrate	-	4.5	4.5	-	2.7	2.7
DMI Corn silo	-	0.0	0.0	-	0.6	0.6
DMI TOTAL	15.5	14.7	13.4	13.7	13.2	10.8

Where: CF=Canada Farm. CHF=Chiquique Farm; DMI= dry matter intake (kg.d^{-1}); Models NRC=National Research Council, 2001, 2M= Double Sampling , Mer= Mertens.

Source: own elaboration.

TABLE 6. Relationship between dry matter intake, milk production and efficiency ratio for Jer-Hol cows

DESCRIPTOR	CF			CHF		
	NRC	2M	Mer	NRC	2M	Mer
DMI (kg/day)	15.5	14.7	13.4	13.7	13.2	10.8
Milk production (kg/day)	18.0	18.0	18.0	14.8	14.8	14.8
Gross biological efficiency	1.16	1.22	1.34	1.08	1.12	1.37

Where: FC=Canadá Farm. FCH=Chiquique Farm; DMI= dry matter intake (kg.d^{-1}); Models NRC=National Research Council, 2001, 2M= Double Sampling , Mer= Mertens.

Source: own elaboration.

CONCLUSIONS

The cows in this study allocated an average of 35.10% of their daily time to grazing, 31.10% to rumination, 22.60% to resting (neither grazing nor ruminating), 1.75% to drinking, and 9.45% to milking, including the time spent traveling to the milking parlor.

The gross biological efficiency of Jer-Hol cows under grazing conditions ranged between 1.16 and 1.08 kg of milk per kg of DMI. This efficiency is influenced by pasture quality and is closely tied to the increased time dedicated to grazing and rumination compared to other activities.

CONFLICT OF INTERESTS

This manuscript was prepared and reviewed with the participation of all authors, who declare that there are no conflicts of interests that could compromise the validity of the results presented.

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This work was carried out using personal resources.

USE OF ARTIFICIAL INTELLIGENCE

No artificial intelligence tools were used in the development of this work.

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