Performance of rotational grazing of Urochloa hybrid cv Cayman in the Caribbean region of Costa Rica

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Abstract
In Costa Rica pasture-based grass is the basis for both dairy and beef production. The Caribbean region with a rainfall exceeding 3000 mm has four seasons: dry (Feb-May), rainy (May-Aug), less rainy (Sep-Oct) and intermediate (Oct-Feb). Many pastures are dominated by *Ischaemum ciliare* ("Retana"), of poor nutritional quality and permanently grazed with low stocking rates (one animal per ha). To assess the potential of combining improved grasses with rotational grazing, a trial with *Urochloa* hybrid cv. Cayman was implemented at the INTA research station in Guápiles, Limón province, during four years (2014 to 2018). An intensive pasture management system based on the Voisin rational grazing methodology was applied in 21 paddocks of 0.2 ha, using 10-15 Brahman or Brahman x Simbrah steers, with 2.3 days of grazing and 46 days of pasture regrowth.
For each year, the effect of growing season was determined on botanical composition, biomass production, intake and live weight gain. The botanical composition remained generally unchanged, with some encroachment of *I. ciliare*. Dry matter production increased during the first three years from 3.8 to 6.7 Mg, stabilizing in the fourth year; biomass availability was highest during the rainy season (6.6 Mg of DM/ha) and lowest during the dry season (4.2 Mg of DM/ha). Intake was 2.4% of live weight. Dry matter digestibility and crude protein content were 61% and 7% respectively. Average stocking rate was 2.4 Livestock Units (of 450 kg LW) per ha. The climatic seasons affected significantly LWG, which varied from 0.40 (intermediate season) to 0.82 (dry season) kg day^{-1} $animal^{-1}$.
Intensive rotational grazing with improved grass cv. Cayman lead to superior forage availability, stocking rates and LWG. However, very humid conditions reduce daily live weight gain by 50% and ways must be sought to improve animal wellbeing during the rainy periods.

Key words: *Urochloa* hybrid cv. Cayman; rotational grazing; climatic season; Caribbean; Costa Rica

Introduction

In Costa Rica pasture-based grass is the basis for both dairy and beef production. Many pastures are dominated by *Ischaemum ciliare* ("Retana"), of poor nutritional quality and permanently grazed with low stocking rates (one animal per ha).
In the humid tropics of Costa Rica, pasture research has demonstrated that short grazing periods increase animal performance (Ibrahim, 1994; Hernández et al. 1995; Hernández et al. 2014). Rotational grazing (like Voisin-style rational grazing) improves forage utilization and promotes nutrient cycling to maintain primary productivity through short (one to three days) grazing periods with high stocking rates (Sánchez et al 1997; Senra et al 2005, Sorio, 2012) preventing animals grazing the same plant twice.
To assess the potential of combining improved grasses with rotational grazing and compare biomass yield, botanical composition and liveweight gain of cattle for different climatic seasons, a trial with *Urochloa* (also known as *Brachiaria*) hybrid cv. Cayman was implemented from October 2014 to December 2018.

Study Site and Methods

The research was conducted at the INTA (Instituto Nacional de Innovación y Transferencia en Tecnología Agropecuaria) research station "Los Diamantes", located in Guápiles, Limón Province, Costa Rica, with an

annual precipitation of 4332 mm and an average daily temperature of 24.6 °C. The site is characterized by four climatic seasons: dry (15 Feb- 14 May), rainy (15 May- 31 Aug), less rainy (1 Sep- 15 Oct) and intermediate (16 Oct- 14 Feb).
In 2012 a pasture of 4.35 ha was sown with certified seed of *U*. hybrid cv. CIAT BR02/1752 Cayman® (Semillas Papalotla), by broadcasting at a rate of 7 to 8 kg per ha. In 2014 the pasture was divided into 21 paddocks, of which 14 with two days (Mondays to Thursdays) and 7 with three days (Fridays to Sundays) occupancy resulting in a weighted average of 2.4 grazing days per paddock with 46 days of pasture regrowth. Each year, the effect of growing season was determined on botanical composition, biomass production, intake and live weight gain. Five groups (four Brahman, one Brahman x Simbrah cross) of 10-15 animals each were used with an initial average weight of 358 kg. Every 30 days the animals were weighed.

Forage availability and botanical composition
Every two grazing cycles prior to the entry of the animals forage availability was estimated using the dry weight range method proposed by Haydock and Shaw (1975). In each paddock, three representative sites were selected and evaluated on a scale from 1 to 3, representing lowest and highest forage availability respectively, and dry matter biomass was determined. Using these data as a calibration, observers visually assessed 30 points and estimated forage production using regression.
Botanical composition was determined every four grazing cycles, using the dry weight range method proposed by 't Mannetje and Haydock (1963). For this, a 0.25 m^2 frame was used at the same sampling points for the estimation of forage availability and species were ranked in terms of dry matter weight.
Pest and disease incidence was assessed using a 5 point scale, where 1 is absence of damage and 5 is very severe damage (Toledo, 1982).

Results
No interaction year x season was found for any of the agronomic variables.
Botanical composition did not differ between the different seasons, but between years significant differences were found for Cayman, *I. ciliare* and broadleaf species other than legumes.
Cayman yield differed significantly between years. Dry matter production increased during the first three years from 3.8 to 6.7 Mg, stabilizing in the fourth year (Table 1).

Table 1. Pasture botanical composition, yield of *Urochloa* hybrid Cayman under rational Voisin grazing

Year	**2015**	**2016**	**2017**	**2018**
Botanical composition (%)				
U. hybrid cv Caymán	90.1 a	90.8 a	86.9 ab	78.3 b
I. ciliare	4.2 a	5.3 a	7.7 a	15.9 b
Other grasses	0.8 a	0.2 a	0.3 a	0.7 a
Legumes	1.5 a	3.1 a	3.3 a	3.2 a
Other broadleaf species	0.2 a	0.1 a	0.4 a	1.1 b
Cyperaceae	2.7 a	1.2 a	1.4 a	0.84 a
Yield (Mg DM/ha) (42 days)	3.8 a	5.8 b	6.7 b	6.5 b

DM: Dry Matter; Means with a common letter in the same row are not significantly different ($p > 0.05$).

U. hybrid cv Cayman maintained a good cover, with some gradual encroachment of *I. ciliare* and other broadleaves than legumes.
Estimated dry matter intake was 2.43% of liveweight. The average nutrient composition of *U*. hybrid cv Cayman was as follows: Dry Matter 21.5%, Crude Protein 7.0%, Neutral Detergent Fibre 64.3%, Acid Detergent Fibre 37.7, ash 11.4%, lignin 3.2% and Dry Matter digestibility 61%.

Stocking rate varied between 2.1 and 2.9 animals/ha with an average of 2.4. Differences were caused by variations in animal numbers, initial weight and liveweight gain. Cayman grass performed well at all stocking rates.

Table 2 shows the yield of Cayman and the daily liveweight gain of the steers for the different climatic seasons.

Table 2. Effect of season on yield of *U*. hybrid cv Cayman and liveweight gain

Season	Yield Cayman (Mg DM/ha)	Liveweight gain (g/animal/day)
Dry (15 Feb- 14 May)	5.9 ab	0.83 a
Rainy (15 May- 31 Aug)	6.6 a	0.61 b
Less Rainy (1 Sep- 15 Oct)	5.7 ab	0.55 b
Intermediate (16 Oct- 14 Feb)	4.2 b	0.39 c

Means with a common letter in the same row are not significantly different ($p > 0.05$).

Liveweight gain is highest in the dry season ($p < 0.05$), whereas biomass yield is one of the highest, but not significantly differing from the rainy and less rainy seasons. However, the rainy season with highest biomass production shows a significantly lower liveweight gain in comparison to the rainy season. During the intermediate season, liveweight gain is significantly lower than during the other seasons, with also lowest biomass availability.

Discussion

The relatively high intake of the pasture can be related to the good digestibility and low lignin levels. In rotational grazing (in this case Voisin-style rational grazing) with Cayman grass in the Caribbean region of Costa Rica, variations in liveweight gain respond both to the effect of climate on the animals and biomass availability. The three rainy seasons showed lower liveweight gain than the so-called dry season. Therefore, potential of improved pastures may be underestimated. Adapting grazing conditions leading to increased animal welfare can increase performance, especially in critical weather conditions such as high humidity and excess rainfall.

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