STRATEGIES OF ROTATIONAL STOCKING MANAGEMENT ON WEIGHT GAIN AND PRODUCTIVITY OF HEIFERS GRAZING ON MARANDU PALISADE GRASS[1]

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ABSTRACT: Pasture management can affect plant growth and interfere with the performance of the animals or the productivity of the production system. Marandu palisade grass swards subjected to year-round grazing by crossbred heifers were evaluated. Three stocking systems were tested: 1) a grazing cycle of 28 days (T_{28d}); 2) when the sward reached a pre-grazing height of 30 cm ($T_{0.3m}$), and 3) when the sward reached a pre-grazing height of 30 cm under irrigation (T-irrig$_{0.3m}$). Heifers from treatments T_{28d} and $T_{0.3m}$ were supplemented with dry matter at 1% of BW during winter. Statistical was a completely randomized block split-plot design. The light interception was higher (P<0.001) for T-irrig$_{0.3m}$ during winter. A lower leaf area index (P<0.001) was found for T_{28d}, and $T_{0.3m}$ during winter and for $T_{0.3m}$ during autumn. There was an effect of stocking systems (P=0.0055), season (P<0.001) and interaction (P<0.0001) on weight gain (WG), stocking rate and productivity. The lowest WG was obtained in winter for the T-irrig$_{0.3m}$ treatment. The mean WG was 0.45, 0.49 and 0.43 kg/day for T_{28d}, $T_{0.3m}$ and T-irrig$_{0.3m}$, respectively. Lower productivity (P=0.0155) was observed for T_{28d} when compared to $T_{0.3m}$ and T-irrig$_{0.3m}$. The productivity rates were 662.2, 741.7 and 758.3 kg WG/ha, per season for T_{28d}, $T_{0.3m}$ and T-irrig$_{0.3m}$, respectively.

Keywords: *Brachiaria brizantha*, canopy height, morphological composition.

ESTRATÉGIA DE MANEJO EM PASTEJO ROTACIONADO NO GANHO DE PESO E PRODUTIVIDADE DE NOVILHAS PASTEJANDO CAPIM MARANDU

RESUMO: O manejo de pastagens pode afetar o crescimento das plantas e interferir no desempenho dos animais ou na produtividade do sistema de produção. Sistemas de pastejo de capim marandu foram avaliados durante um ano, sendo ocupados por novilhas mestiças. Três sistemas de pastejo foram avaliados: 1) ciclos de pastejos fixos com 28 dias (T_{28d}); 2) pastejos iniciados quando a altura da planta era de 30 cm ($T_{0,3m}$), e 3) pastejos iniciados quando a altura da planta era de 30 cm recebendo irrigação (T-irrig$_{0,3m}$). As novilhas dos tratamentos T_{28d} e $T_{0,3m}$ foram suplementadas durante o inverno seco em 1% do peso vivo. O delineamento foi em blocos casualisados e medidas repetidas no tempo. A interceptação luminosa foi maior (P<0,001) para T-irrig$_{0,3m}$ durante o inverno. Menor índice de área foliar (P<0,001) foi observada para T_{28d}, e$T_{0,3m}$ no inverno e para $T_{0,3m}$ durante o outono. Houve efeito de sistema de pastejo (P=0,0055), estação do ano (P<0,001) e interação (P<0,0001) no ganho de peso (GP), taxa de lotação e produtividade. O menor GP foi obtido no inverno e no tratamento T-irrig$_{0,3m}$. As médias de GP foram 0,45, 0,49 e 0,43 kg/dia para T_{28d}, $T_{0,3m}$ e T-irrig$_{0,3m}$, respectivamente. Menor produtividade (P=0,0155) foi observada em T_{28d} quando comparado com $T_{0,3m}$ e T-irrig$_{0,3m}$. As produtividades foram 662,2, 741,7 e 758,3 kg GP/ha por estação do ano para T_{28d}, $T_{0,3m}$ e T-irrig$_{0,3m}$, respectivamente.

Palavras-chave: altura do dossel, *Brachiaria brizantha*, composição morfológica.

INTRODUCTION

The management of grassland ecosystems must balance many competing demands, including food production, livelihoods and ecosystem services. Since grasslands play an important role worldwide, they need to be well managed in order to best fulfill different functions. Knowledge is often lacking, particularly for tropical grasslands (Boval and Dixon, 2012).

The area planted with marandu palisade grass *Brachiaria brizantha* (Hochst ex A. Rich.) Stapf. (synonym *Urochloa brizantha*, cultivar marandu) in Central Brazil is very large, almost 10 million hectare and it is well accepted by cattle producers (Hering *et al*., 2011).

Stock rotation is a tool to improve forage quality and productivity in tropical swards. Experimental data are still needed to understand the relationship between the different components of pasture (Boval and Dixon, 2012). The easiest rotational stocking systems are to use a fixed number of days to occupy or rest the paddock. However, Braga *et al*. (2009) investigated marandu palisade grass and concluded that the flexible use of paddocks in a rotational system could minimize negative effects and improve productivity.

Management strategies that consider the phenology and physiology of herbage species can increase sward production and longevity (Da Silva *et al*., 2013). In a study on the growth of marandu palisade grass subjected to intermittent stocking strategies conducted by Giacomini *et al*. (2009b), the growth rate improved under rotational grazing of marandu palisade grass at a light interception (LI) of 95%. Plant height and leaf area index (LAI) were 30.4 cm and 5, respectively, at the beginning of grazing, and plant height was 15 cm when grazing stopped in summer (Giacomini *et al*., 2009b).

Studying Nellore steers (*Bos indicus* L.) aged 15 months with an initial weight of 250 kg, Hering *et al*. (2011) estimated a weight gain of 0.47 kg/day on marandu grass sward using equations developed after 24 months of evaluation of pasture availability and weight gain.

The climate of Southwest and Central Brazil is characterized by only two seasons, the rainy season (spring and summer) and the dry season (autumn and winter). Low temperatures or ice occur rarely during winter; therefore, irrigation could be a solution to maintain pasture growth during the dry season. Irrigation increased forage mass production by 55% when compared to non-irrigated marandu palisade grass during the dry season (Dupas *et al*., 2010).

The present study compared a fixed rotational grazing system with a 28-day cycle to a sward management with the best biological efficiency (95% LI and a canopy height of 30 cm) with or without irrigation. The irrigation was used just in treatment with the sward management with height of 30 cm because it was demonstrate higher efficiency of plant growth for this grazing system (Braga *et al*., 2009; Giacomini *et al*., 2009b) and the proposal of the present study was to improve de plant growth during dry periods with efficiency.

In the other hand, during the dry periods (winter) do not had plant growth enough to maintain the weight gain of bovine in the grazing system, than it was necessary to provide roughage supplementation for animals grazing at the non irrigated treatments.

Heifer growth rates and the marandu palisade grass sward were evaluated using three rotational stocking systems: 1) a grazing cycle of 28 days (T_{28d}), with roughage supplementation during winter; 2) when the sward reached a pre-grazing height of 30 cm ($T_{0.3m}$) with roughage supplementation during winter, and 3) when the sward reached a pre-grazing height of 30 cm under irrigation (T-irrig$_{0.3m}$). The study was carried out in year-round to evaluate the duration of grazing cycles and pasture structural components. Stocking rate, heifer weight gain, and productivity were also assessed.

MATERIAL AND METHODS

The experiment was conducted at the experimental station of APTA (Agência Paulista de Tecnologia dos Agronegócios), Mococa, SP, Brazil (21º28′ S and 47º1′ W, and altitude of 665 m) in a well-established marandu palisade grass (*Brachiaria brizantha*, Hochst. ex A. Rich.) pasture.

The area had a undulating surface relief and the soil type was eutrophic Tb Haplic Cambisol (EMBRAPA, 1999) with the following chemical characteristics: pH 4.8; organic matter 31 g dm^3, 8 mg P/dm^3, sum of bases of 32 mmol SB/dm^3, base saturation 38%, 28 mmol Ca/dm^3, 1.8 mmol K/dm^3, and 18 mmol Mg/dm^3. The region has a tropical climate, with dry winters. Maximum and minimum air temperature, rainfall rate, and irrigation (water line) are shown in Figure 1.

Three rotational stocking systems were evaluated over a period of 12 months, subdivided in four seasons, with three grazing cycles per season.

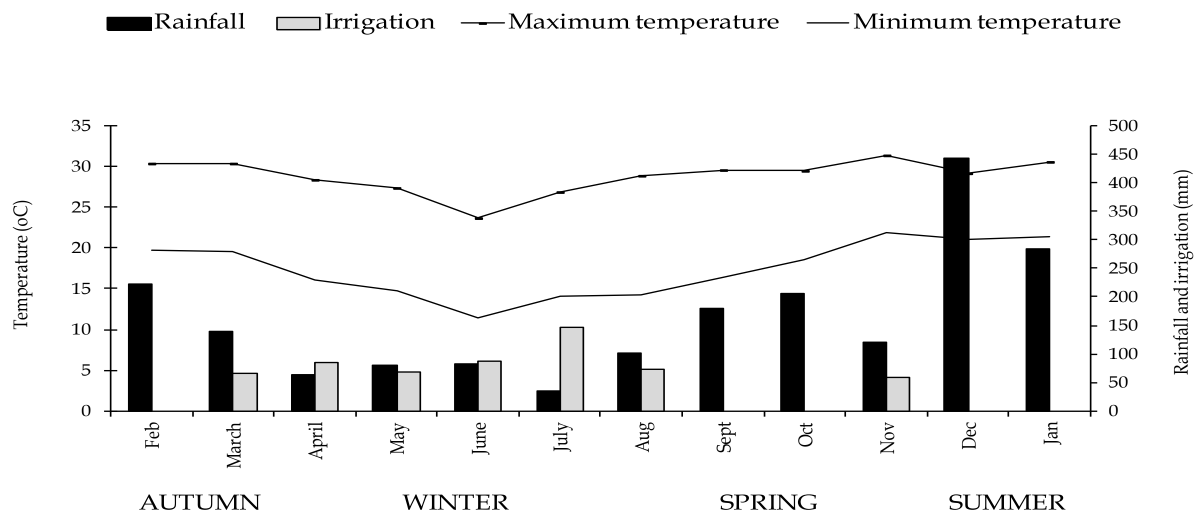

Figure 1. Minimum and maximum temperatures, rainfall and irrigation in the study area.

The first stocking systems consisted of allowing regrowth of the sward for 26 days, followed by 2 grazing days, corresponding to a cycle of 28 days and during winter the heifers grazed the paddocks and received roughage supplementation (T_{28d}). The second stocking system consisted of allowing heifers to graze when the sward reached a pre-grazing height of 30 cm without irrigation and during winter the heifers grazed the paddocks and received roughage supplementation ($T_{0.3m}$), and the third consisted of allowing heifers to graze when the sward reached a pre-grazing height of 30 cm under irrigation (T-irrig$_{0.3m}$), both with 2 to 4 days of occupation depending on plant height. The maximum regrowth period was limited to 56 days for $T_{0.3m}$ and T-irrig$_{0.3m}$. Since pre-grazing conditions were defined in terms of canopy height, grazing dates and resting periods varied for each paddock depending on the prevailing environmental conditions in treatments $T_{0.3m}$ and T-irrig$_{0.3m}$. Because of variation in grazing and resting periods of $T_{0.3m}$ and T-irrig$_{0.3m}$, just two grazing cycles was evaluated for winter season.

The stocking systems were implemented in 44 paddocks (1,200 m^2), with 15 paddocks per treatment in $T_{0.3m}$ and T-irrig$_{0.3m}$ and 14 paddocks in T_{28d}, in three blocks.

The paddocks were cleared before the experiment in order to eliminate forage remnants, with a stubble height of 5 cm. The swards received top-dressing consisting of 160 kg of N per ha, per year, before the experiment and at the end of each grazing cycle (except for the last cycle).

In the irrigation treatment (T-irrig$_{0.3m}$), the water was supplied by a fixed conventional sprinkler system, with an outflow of 26 m^3 per hour. Twelve soil moisture sensors (40 kPa, Irrigas®) were used per paddock to measure soil moisture at a depth of 0.2 and 0.6 m. The root sensor was used at a depth of 0.2 m. The irrigation system started when the sensor at 0.2 m accused dry soil. The quantity of water supplied is shown in Figure 1.

The paddock was the experimental unit to evaluate the pre-grazing canopy height, LI, LAI, forage mass and leaf proportion, stocking rate and productivity.

Four paddocks were sampled per treatment for each replicate (block) and grazing cycle. Canopy height, LI and LAI were measured at 15 sites in the sward per paddock under pre-grazing conditions. At each sampling point, canopy height was measured with a ruler as the distance from the curve formed by the upper leaves to the ground; LI and LAI were measured using the AccuPAR LP80 system (Decagon Devices).

Four 0.25 × 0.25 m sward patches were collected from each paddock and pooled. The sward was cut close to the ground and weighed to determine forage mass. After the whole sample had been weighed, a subsample was separated to determine leaf blade proportion. The samples were dried in a forced air oven at 60^{o}C until a constant weight was attained.

Crossbred dairy heifers (Holstein x Gir) with an average live weight of 228.2± 48.5 kg were used. To evaluate the weight, the heifer was the experimental unit. Each paddock was grazed by 10 tester animals and put-and-take heifers were added or removed to adjust stocking rates according to the criterion of maintaining a constant residual pasture height at 10 cm after 2 or 3 days of grazing.

The animals from treatments T_{28d} and $T_{0.3m}$ received 1% live weight supplementation during winter (90 days), which consisted of 75% sorghum silage and 25% soybean meal (DM basis). Tester and put-and-take heifers were weighed after a 12-hour fast. Weight gain was measured monthly and one heifer equivalent was 250 kg body weight. The stocking rate was defined as total weight divided by 250 kg per ha in each experimental paddock. The area productivity was calculated considering the stocking rate and the sum of weight gained over 90 days, the period corresponding to each season.

Statistical analysis was performed using a repeated measures procedure (three or two grazing cycles per season). The model included the fixed effects of stocking systems, season and interaction between stocking systems and season, and block as random effect. Data were analyzed using the MIXED procedure of the SAS software (SAS, Inst. Inc., Cary, NC, USA). The Akaike information criterion was applied to select the variance and co-variance matrix (Wolfinger, 1993). This approach permitted to detect the effects of stocking systems, seasonality and interaction between these factors. Means were estimated using LSMEANS and compared using difference probabilities (PDIFF) by the Tukey test at a level of 0.05.

RESULTS AND DISCUSSION

The number of days necessary for the regrowth of marandu palisade grass varied according to season, demonstrating that the different stocking systems (T_{28d}, $T_{0.3m}$ and T-irrig$_{0.3m}$) had specific growth rhythms. Grazing cycle was not constant in $T_{0.3m}$ or T-irrig$_{0.3m}$ (Table 1), lasting 30 days in autumn and increasing progressively until an average cycle of 45 days in winter and spring, reaching 60 days during one grazing cycle in winter. The target of a pre-grazing plant height of 30 cm for $T_{0.3m}$ and T-irrig$_{0.3m}$ was not reached in autumn, winter or spring. The pre-grazing height was greater (P<0.0001) in T_{28d} than in $T_{0.3m}$ and varied according to season (P<0.0001) (Table 1). An interaction effect of stocking system and season was observed for pre-grazing height (P=0.0205). The greatest pre-grazing height was observed in T_{28d} during summer, whereas the lowest occurred during winter in all treatments (Table 1).

Swards managed by $T_{0.3m}$ had a lower LI (P<0.0001) than T_{28d} and T-irrig$_{0.3m}$. The LI was affected by season (P<0.0001) and by the interaction between stocking system and season (P=0.0389). Light interception was lower in spring and higher in summer for all treatments; however, particularity in autumn was $T_{0.3m}$ associated with lower LI when compared to T_{28d} and T-irrig$_{0.3m}$.

The LAI was lower (P<0.0001) in swards subjected to $T_{0.3m}$ compared to T_{28d} and T-irrig$_{0.3m}$. Season (P<0.0001) and the interaction between stocking systems and season (P=0.04487) affected the LAI. In contrast to T_{28d} and $T_{0.3m}$, a higher LAI was observed for T-irrig$_{0.3m}$ during winter (Table 1).

A pre-grazing plant height of 30 cm for marandu palisade grass is ideal to start paddock occupation in a rotational grazing system (Giacomini *et al*., 2009b), however, this target was not achieved in the $T_{0.3m}$ and T-irrig$_{0.3m}$ treatments for most part of the year, especially during winter when the plants did not grow enough to reach a height of 30 cm and the LI was less than the 95% target. Gimenes *et al*. (2011) also investigated marandu palisade grass in a rotational system with pre-grazing heights of 25 and 35 cm and found that plant height did not meet the target during autumn and winter in Southeast Brazil.

To maximize the use of paddocks, the maximum period allowed for a grazing cycle was 60 days, irrespective of plant height or LI. For $T_{0.3m}$ and T-irrig$_{0.3m}$, the maximum duration of the grazing cycle was 60 days at the end of winter and in the first cycle at the beginning of spring, while grazing cycles lasted on average 30 days in summer. Similar results have been reported by Giacomini *et al*. (2009a) for year-round grazing on marandu palisade grass when plant height ranged from 20.5 to 30.4 cm.

A plant height of 30 cm as a strategy to initiate the grazing period in the rotational system could be used during spring and summer to maximize plant growth and to improve conditions for rapid sward re-establishment. During autumn and winter when the minimum temperature is less than 18^{o}C (Figure 1), even when irrigation is used during the dry season, plant height should be less than 30 cm or an occupation period should be established to organize paddock use in an attempt to increase land use efficiency.

All treatments achieved an LI close to the target of 95% during the 90 days of summer, whereas T_{28d}

Table 1. Duration of grazing cycle, pre-grazing canopy height, light interception (LI) and leaf area index (LAI) in marandu palisade grass swards subjected to intermittent stocking systems

Stocking System	Season					[1]SEM	P value Stocking system	P value Season	P value Interaction
	Autumn	Winter	Spring	Summer	Mean				
Cycle duration (days)									
T_{28d}	28	28	28	28	28				
$T_{0.3m}$	40	45	45	30	40				
T-irrig$_{0.3m}$	30	45	45	30	38				
Pre-grazing canopy height (cm)									
T_{28d}	28.9 abA	20.9 bA	22.7 bA	36.1 aA	27.1 A	2.1	<0.0001	<0.0001	0.0205
$T_{0.3m}$	21.0 bB	19.1 bA	19.7 bA	30,4 aB	22.6 B	2.7			
T-irrig$_{0.3m}$	27.9 aA	21.6 bA	22.2 bA	31,2 aB	25.7 AB	2.9			
Mean	26.0b	20.5 c	21.6 c	32.6 a					
Pre-grazing LI (%)									
T_{28d}	92 aA	85 bB	86 bA	94 aA	89.2 A	4.8	<0.0001	<0.0001	0.0389
$T_{0.3m}$	84 bB	85 bB	84 bA	94 aA	84.2 B	3.1			
T-irrig$_{0.3m}$	93 aA	91 aA	81 bA	94 aA	89.7 A	3.4			
Mean	86 b	87 b	84 c	94 a					
Pre-grazing LAI									
T_{28d}	5.9 bA	3.7 dB	4.4 bcA	7.2 aA	5.3 A	0.21	<0.0001	<0.0001	0.0487
$T_{0.3m}$	4.3 bB	3.8 bB	4.1 bA	6.7 aA	4.7 B	0.17			
T-irrig$_{0.3m}$	5.7 bA	4.6 cA	4.5 cA	7.2 aA	5.5 A	0.24			
Mean	5.3 b	4.0 b	4.3 b	7.0 a					

[1]Standard error of the mean.
Means followed by the same uppercase letter in a column and lowercase letter in a row do not differ significantly (P > 0.05).

and T-irrig$_{0.3m}$ were also close to the target in fall and T-irrig$_{0.3m}$ in winter (Table 1).

The LAI was lower for $T_{0.3m}$ compared to T_{28d} and T-irrig$_{0.3m}$, but a higher LAI was observed in summer for all treatments. Irrigation during the winter season had a positive effect on the LAI in T-irrig$_{0.3m}$. The higher LAI (Table 1) provided a higher stocking rate in T-irrig$_{0.3m}$ (Table 3), improving productivity of the system. Similar to the present results, Giacomini *et al*. (2009a) reported an LAI of 4.1 in spring and of 6.1 in summer for marandu palisade grass subjected to intermittent stocking systems. Braga *et al*. (2008) also observed LAI ranging from 5.3 to 6.0 during summer in marandu palisade grass swards with 20% of herbage allowance.

The stocking system did not affect (P=0.4559) pre-grazing forage mass, but there was an effect of season (P<0.0001), with all treatments producing lower pre-grazing forage mass during winter and spring (Table 2). No interaction (P=0.5529) was observed between stocking system and season (Table 2).

Neither stocking systems (P=0.6780) nor the interaction between treatment and season (P=0.2211) affected leaf blade proportion, which was lower (P<0.0001) during winter in all treatments (Table 2).

The combination of low temperature during the dry season and high temperatures and soil moisture during the rainy season (Figure 1) affected pre-grazing forage mass. The lower pre-grazing forage mass observed during winter and spring (Table 2) was mainly due to low temperatures from May to September (Figure 1), since irrigation had not improved forage mass at that time (Table 2). In a study using non-irrigated marandu palisade grass, the pre-grazing forage mass was 3.8 t DM/ha in August (winter and dry season) and 4.8 t DM/ha in November (late spring), in agreement with the present study (Canesin *et al*., 2014).

An effect of the winter period on leaf blade

Table 2. Pre-grazing forage mass and leaf proportion in marandu palisade grass swards subjected to intermittent stocking systems

Stocking system	Season					SEM[1]	P value Stocking system	P value Season	P value Interaction
	Autumn	Winter	Spring	Summer	Mean				
Forage mass (kg DM/ha)									
T_{28d}	4418.6	4152.4	4409.8	5790.5	4692.8	328.2	0.4559	<0.0001	0.5529
$T_{0.3m}$	4804.8	4006.2	4348.7	5866.0	4756.4	289.4			
T-irrig$_{0.3m}$	5725.0	4159.8	4462.4	5722.0	5017.3	388.3			
Mean	4982.8 a	4106.1 b	4406.9 b	5792.8 a					
Leaves (% DM/ha)									
T_{28d}	25.3	22.6	31.5	29.5	27.3	1.27	0.6780	<0.0001	0.2211
$T_{0.3m}$	28.6	22.1	31.8	32.5	28.7	1.58			
T-irrig$_{0.3m}$	33.6	20.8	27.4	32.5	28.6	1.25			
Mean	29.10 a	21.80 b	30.24 a	31.50 a					

[1]Standard error of the mean.
Means followed by the same uppercase letter in a column and lowercase letter in a row do not differ significantly (P > 0.05).

proportion was observed in all treatments (Table 2), including the irrigation treatment (T-irrig$_{0.3m}$) in which leaf proportion was so low that it affected the weight gain of heifers fed exclusively on irrigated pasture during the dry season (autumn and winter). Canesin *et al*. (2014) found very low leaf proportion during the dry season (8.6% and 6.6% of forage mass) in Southeastern Brazil. However, the authors reported results similar to those obtained in the present study for spring (31.2% in October and 32.4% in November). A study conducted in Thailand comparing tropical grasses that lasted 3 years found an average of 9,231 kg DM/ha (sum of four cuts) in the wet season (7-8 months) and 2,149 kg DM/ha (4-5 months) in the dry season, with a leaf proportion of 64.2% and 80%, respectively. The evaluation was made in plant beds, in line, cut 5 cm above ground level, without the use of grazing animals (Hare *et al*., 2009). Only cut plants can interfere with regrowth, minimizing stem elongation as a response to intermittent grazing management.

Heifer weight gain was affected by treatment (P=0.0055), season (P<0.0001) and the interaction between treatment and season (P<0.0001). The low leaf proportion during winter in T-irrig$_{0.3m}$ particularly affected heifer weight gain when compared to $T_{0.3m}$ and T_{28d}. In the latter treatments, the heifers were supplemented because the dry weather prevented the grass from growing (Table 3).

Treatment (P=0.0020), season (P<0.0001) and interactions (P=0.0003) affected the stocking rate (heifers of 250 kg/ha). The stocking rate was lower (P<0.0001) in T_{28d} and directly affected the productivity of this management (Table 3).

Productivity was affected by stocking systems (P=0.0155), season (P<0.0001) and the interaction between stocking systems and season (P = 0.0022). Higher productivity was observed for $T_{0.3m}$ and T-irrig$_{0.3m}$ mainly during winter and spring (Table 3). Particularly T-irrig$_{0.3m}$ exhibited higher productivity during spring.

The weight gain of heifers was lower in all treatments (Table 3) during autumn and winter as a result of the decrease in forage mass and leaf proportion (Table 2), which occur naturally in tropical environments characterized by a dry season and temperatures below 18ºC. The weight gain of heifers grazing under treatments $T_{0.3m}$ and T_{28d} in winter was similar to that observed in spring and summer when temperatures and soil moisture increased forage mass production. Casagrande *et al*. (2013) studied the post weaning weight gain of Nellore heifers with an initial live weight of 214 kg grazing on marandu palisade grass from summer to autumn. The authors observed similar weight gain ranging from 0.46 to 0.43 kg/day for heifers supplemented only with mineral salt, in agreement with the present findings.

Stocking rate (heifers of 250 kg/ha) and productivity were affected by the treatments. Only the irrigation treatment was able to maintain high year-round stocking rates, especially during

Table 3. Weight gain, stocking rate and productivity of heifers grazing on marandu palisade grass swards subjected to intermittent stocking systems

Stocking system	Season					[1]SEM	P value Stocking system	P value Season	P value Interaction
	Autumn	Winter	Spring	Summer	Mean				
Weight gain (kg/day)									
T_{28d}	0.42 bA	0.45 abA	0.46 abA	0.49 aA	0.45 AB	0.021	0.0055	<0.0001	<0.0001
$T_{0.3m}$	0.44 bA	0.47 abA	0.52 aA	0.55 aA	0.49 A	0.023			
T-irrig$_{0.3m}$	0.39 bB	0.26 cB	0.54 aA	0.55 aA	0.43 B	0.022			
Mean	0.42 b	0.39 b	0.51 a	0.53 a					
Stocking rate (heifers of 250 kg/ha)									
T_{28d}	10.9 aA	7.2 bB	6.2 cB	9.3 aB	8.4 B	0.9	0.0020	<0.0001	0.0003
$T_{0.3m}$	12.7 aA	8.7 bB	9.3 bAB	14.0 aA	11.2 A	1.2			
T-irrig$_{0.3m}$	11.4 Aa	13.1 aA	11.0 aA	13.5 aA	12.2 A	1.2			
Mean	11.7 a	9.7 ab	8.9 b	12.2 a					
Productivity (kg/ha)									
T_{28d}	657.0 bA	622.7 bA	521.0 cC	847.9 aB	662.2 B	59.6	0.0155	<0.0001	0.0022
$T_{0.3m}$	485.8 cB	667.5 bA	697.5 bB	1116.0 aA	741.7 A	69.8			
T-irrig$_{0.3m}$	621.0 bA	586.5 cA	890.7 abA	934.9 aA	758.3 A	79.4			
Mean	657.0 b	622.7 b	521.0 c	847.9 a					

[1]Standard error of the mean.

Means followed by the same uppercase letter in a column and lowercase letter in a row do not differ significantly (P > 0.05).

winter, while $T_{0.3m}$ and T-irrig$_{0.3m}$ presented similar mean stocking rates and productivity (Table 3). The higher stocking rates observed in $T_{0.3m}$ and T-irrig$_{0.3m}$ resulted in the best productivity, although the worst weight gain was observed for T-irrig$_{0.3m}$ in winter. The efficient use of grass pastures is associated with high stocking rates which, in turn, may reduce the individual weight gain of animals, as observed in a study on herbage allowance of palisade grass (Braga *et al*., 2008).

CONCLUSION

Different managements in stocking systems affect sward height, light interception, leaf area index, stocking rates and productivity. Management of palisade grass using pre-grazing height of plant of 30 cm presents better stocking rate and productivity than the 28 fixed days for re-growth.

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