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Rotational stocking management affects the structural and nutritional characteristics of Guinea grass swards and milk productivity by crossbred dairy cows

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ABSTRACT

The type of stocking system can affect sward canopy structure, changing the nutritional value of herbage and livestock production. The present study evaluated structural and nutritive features of Guinea grass (*Panicum maximum* Jacq. var. *Tanzânia*) swards and the composition and yield of milk produced by crossbred cows fed this herbage in a rotational stocking system over cycles from Spring to Autumn. Two stocking systems were tested, in which cattle were allowed to graze: (1) after grazing cycles of 30 days (T_{30d}); or (2) when the sward reached a pre-grazing height of 70 cm ($T_{0.7m}$). Five grazing cycles, each consisting of a sward recovery period followed by 2 days of grazing, were evaluated in each stocking system using a completely randomized block design and repeated measures with 2 repetitions per stocking system (each composed of a set of sixteen 4000 m^2 paddocks grazed sequentially). Four 1 m × 1 m sward patches were collected, constituting one sample per paddock, which was used to evaluate pre-grazing herbage mass, leaf, stem and dead matter (dry mass per area), crude protein (CP), neutral detergent fiber (NDFom), acid detergent fiber (ADFom) and hemicellulose (HEM). Cows received daily supplementation of 4 kg concentrate. Stocking rate, milk production and composition were evaluated in each grazing cycle. The T_{30d} stocking system produced higher (P=0.0014) pre-grazing height than $T_{0.7m}$ (0.83 *vs* 0.69 cm), had higher (P=0.0071) light interception (94 *vs* 91%) and higher (P=0.0233) leaf area index (5.2 *vs* 4.5). In addition, T_{30d} exhibited larger (P=0.0204) herbage mass than $T_{0.7m}$ (7276 *vs* 6187 kg MS/ha), higher (P= 0.0243) leaf dry mass per area (2618 *vs* 2294 kg/ha) and higher (P<0.0001) stocking rate (6.2 *vs* 5.7 animal/ha). The grazing cycle affected sward composition, with T_{30d} producing higher (P=0.0060) leaf NDFom. Milk production and composition was not affected by the stocking systems, as follows (T_{30d} *vs* $T_{0.7m}$): 20.12 *vs* 20.94 kg milk production per cow/day; 31.4 *vs* 31.9 g fat/kg, 29.9 *vs* 30.2 g protein/kg, 43.7 *vs* 44.6 g lactose/kg, 114.8 *vs* 116.5 g/kg total solids and 12.85 *vs* 12.86 mg/dL ureic

Abbreviations: ADFom, acid detergent fiber excluding residual ash; BW, body weight; CP, crude protein; DM, dry matter; HEM, hemicellulose; LAI, leaf area index; LI, light interception; MUN, milk ureic nitrogen; NDFom, neutral detergent fiber excluding residual ash; AU, animal unit of 450 kg; SB, sum of bases; V%, base.

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nitrogen. Stocking system therefore affects the nutritive value of sward. Stocking management allowing a 30-day grazing cycle for Guinea grass sward (T_{30d}) produces higher forage mass, supporting a higher stocking rate and thereby increasing productivity in dairy farm.

1. Introduction

Many cow producers, including dairy cattle farmers, adopt rotational stocking as a low-cost method for maintaining quality in tropical swards. Other studies have shown that, compared to traditional methods, rotational stocking can significantly increase the productivity of tropical grass swards (Carnevalli et al., 2006; Difante et al., 2009).

In rotational stocking systems, the fallowing period is important for grass re-growth without pasture degradation and good forage quality for ruminants. In a study on two Guinea grass varieties, a 28-day fallow period was found to minimize stem proportion and improve forage quality compared to 38 and 48 days (Santos et al., 1999).

Management strategies that consider the phenology and physiology of herbage species can enhance sward production and longevity (Fulkerson and Slack, 1994; Da Silva et al., 2009). The use of light interception (LI) as a reference for monitoring re-growth allows herbage to be harvested in a same physiological condition, according to variations in its accumulation. Given that the pattern of herbage accumulation depends on LI and competition for light, a criterion of 95% LI can be assumed to indicate re-growth interruption. This is because, in addition to indicating more efficient leaf accumulation in grazing systems, it is easily identified in the field by canopy height. The pre-grazing height that corresponds to 95% LI in re-growth of tropical grasses exhibits a uniform and consistent pattern, similar to that reported for temperate grasses (Carnevalli et al., 2006; Barbosa et al., 2007; Difante et al., 2009).

In an assessment of Tanzania Guinea grass quality at canopy heights of 60, 70 and 85 cm, 95% LI was reached by 70 cm plants (Difante et al., 2009). Other studies confirmed that Guinea grass swards under an intermittent defoliation regime consistently achieved 95% LI at a canopy height of 70 cm, irrespective of residual herbage mass (Mello and Pedreira, 2004; Barbosa et al., 2007).

The present study compared an easy rotational system for milk producers combining fixed 30-day grazing cycles and the sward system with the best biological efficiency, that is 95% LI with a canopy height of 70 cm. As such, production and quality of Guinea grass swards was evaluated under two rotational stocking systems: (1) in fixed 30-day grazing cycles (T_{30d}), with 2-day grazing followed by 28-day fallowing; (2) in a variable grazing cycle of 2 days followed by fallowing until sward canopy reached a pre-grazing height of 70 cm ($T_{0.7m}$). Because Guinea grass development is affected by seasonality, with better growth in the rainy summer (Montagner et al., 2012), the study was carried out in grazing cycles over the year. Stocking rate, milk production and milk productivity by crossbred dairy cows grazing under both systems were also assessed.

2. Materials and methods

The experiment was conducted on the APTA experimental farm (*Agência Paulista de Tecnologia dos Agronegócios*), Midwest Unit, Ribeirão Preto, SP (21°42′ S, 47°24′ W and 535 m altitude), in well-established Guinea grass swards (*Panicum maximum* Jacq. var. *Tanzânia*). Relief in the area is slightly wavy, and soil type is Oxisol (*Latossolo Vermelho Epidistroférrico*, EMBRAPA, 1999) with the following chemical characteristics: pH 5.1; organic matter 40 g/dm^3; 12 mg P/dm^3; sum of bases of 41.5 mmol SB/dm^3; base saturation of 42%, 30 mmol Ca/dm^3, 2.6 mmol K/dm^3, and 18 mmol Mg/dm^3. Climate is tropical, with dry winters. Maximum and minimum air temperature and rainfall rate are shown in Fig. 1.

2.1. Stocking system

Two rotational stocking systems were evaluated over 5 grazing cycles. The first system allowed the sward to re-growth during 28 days and 2 occupation days. The grazing cycle has 30 days (T_{30d}), while the other allowed dairy cows to graze when the sward reached a pre-grazing height of 70 cm ($T_{0.7m}$), with 2 days of grazing. The stocking systems were installed

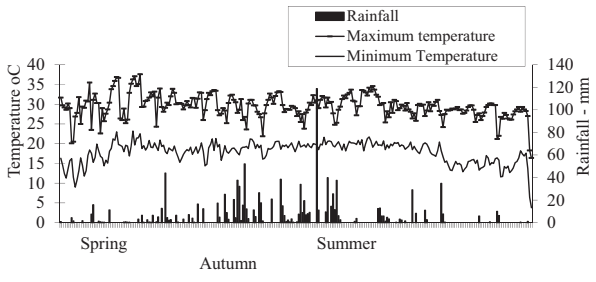

Fig. 1. Minimum and maximum temperatures and rainfall in the study area.