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Production, Forage Quality, and Performance of Holstein Cows under Intermittent Grazing on Tifton 85

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Abstract

Tropical forage grasses compose the base diet of the Brazilian cattle herd due to their low production cost, high production potential, and good adaptation to various Brazilian ecosystems. In recent years, the search has intensified for alternatives that increase the yield in pasture milk production systems. Thus, the present study evaluated the production and quality of Tifton 85 grass in relation to the production parameters (*e.g.* greater leaf: stem ratio), and milk quality of Holstein cows in an intermittent grazing system during different seasons of the year. The experiment was conducted at the Córrego da Ponte Farm in Santa Helena de Goias, Goias, Brazil, from April 2014 to March 2015. The experiment used a completely randomized design with nine replicates and the four seasons (fall, winter, spring, and summer) as treatments. The Holstein cows had a live weight of 560±36.8 kg and averages four years of age. The grazing method used was a mob-stocking, with one day of grazing and 19 days of rest. The results showed that Tifton 85 was efficient regarding production parameters (total dry mass) and forage quality (IVDMD, NDF, ADF). The milk production was satisfactory during the fall, spring, and summer. The forage showed limited production during the winter, due the highest NDF, ADF levels and lower IVDMD ($P < 0.05$), which was directly reflected in the milk yield, fat, protein and lactose ($P < 0.05$). A reduction in the stocking rate or an increase in the number of paddocks is advisable during the winter to maximize milk production without compromising forage development. The correlation data showed the importance of consuming better-quality forage to increase milk production without compromising the levels of milk solids.

Keywords: *Cynodon* spp., forage production, milk quality, seasons

1. Introduction

Tropical forage grasses compose the base diet of the Brazilian cattle herd due to their low production cost, high production potential, and good adaptation to various Brazilian ecosystems. However, the big challenge for producers using grazing the climate presents unique challenges to production. The possibility to grow superior quality forages is of particular concern for graziers (producers using grazing systems) (Fike et al., 2003). Thus, the search has intensified in recent years for strategic alternatives that increase the yield in pasture-livestock production systems (Quaresma et al., 2011). The viability of pasture-livestock production systems depends on the use of high-quality forage and management practices that optimize nutrient intake by the animals, allowing the more efficient use of the resources available to the rancher and little increase in production costs (Maixner et al., 2007).

Brazil stands out in the production and export of various agricultural products. Milk, a product historically associated with the subsistence of small-scale farmers, has always remained outside of higher aggregate value products. However, despite devaluation, the Brazilian dairy herd is the second largest worldwide; therefore, Brazil has a much higher production potential than the production that is presently occurring. The potential of pasture milk production is vast because this production provides an inexpensive and economical food source, which can have a significant impact on a small rural property (Quaresma et al., 2011).

However, one of the greatest problems affecting pasture milk production throughout most of Brazil is the seasonality of forage production. Often, more than 70% of pasture dry matter production is concentrated during the rainy period, with a food shortage problem during the dry period.

The genus *Cynodon* is often used in production systems because of its production characteristics and adaptation to tropical and subtropical conditions, showing striking responsiveness to fertilizer applications (Pereira et al., 2012) and the use of irrigation system (Andrade et al., 2012). Among grasses of the genus *Cynodon*, Tifton 85 stands out as one of the forages most frequently used for milk production under intermittent grazing, exhibiting several favorable characteristics: high dry matter production, leaf/stem ratio, and nutritional value. Due to these characteristics, Tifton 85 is appropriate for feeding high-production livestock (Ribeiro & Pereira, 2011). In addition, the intermittent grazing system described by Allen (2011) known as Mob-stocking, is characterized by heavy grazing, usually one day, with effective control of the plant structure.

Since most of the researches with Tifton 85 occur in southeastern Brazil, experiments in Brazilian savannah are very important to producers, because may be reflected in the milk quality and productivity. Because of the important role that pastures play in most production models, more information of benefit for the use of this system must be generated to ensure that pasture yield and milk production are maintained in Brazil. For these reasons, the present study evaluated the production and the quality of Tifton 85 grass in relation to the production parameters and the milk quality of Holstein cows in an intermittent grazing system during different seasons.

2. Materials and Methods

2.1 Description of the Experimental Area

The experiment was conducted on a dairy farm in the municipality of Santa Helena de Goiás, Go, Brazil, from April 2014 to March 2015 (Figure 1), contemplating the four seasons, in the sequence, autumn, winter, spring and summer. The property is part of the "Balde Cheio" project, which seeks to promote the sustainable development of dairy ranching via technology transfer to meet the extension demands of public and private entities and dairy farmers throughout Brazil.

The soil at the experimental site was classified as a distroferric Red Latosol (Embrapa, 2013) with 530 g kg^{-1} of clay. In May 2014, soil samples were collected from the 0-20-cm layer, and the chemical properties of the experimental site were determined as follows: pH in $CaCl_2$: 5.8; Ca: 2.55 $cmol_c\ dm^{-3}$; Mg: 1.09 $cmol_c\ dm^{-3}$; Al: 0.06 $cmol_c\ dm^{-3}$; Al + H: 2.6 $cmol_c\ dm^{-3}$; K: 0.23 $cmol_c\ dm^{-3}$; cation exchange capacity (CEC): 6.47 $cmol_c\ dm^{-3}$; P: 5.23 mg dm^{-3}; V: 58.9%; and organic matter (OM): 33.50 g dm^{-3}.

Phosphorus was applied in single superphosphate form (120 kg ha^{-1} of P_2O_5), and potassium was applied as potassium chloride and fritted forms (50 and 20 kg ha^{-1} of K_2O and FTE BR 12, respectively). The fertilizers were disseminated in two applications, October 2014 and December 2014, and nitrogen fertilizer (10 kg ha^{-1} of N) was applied as urea every 19 days when the animals left the paddocks.

The pasture grass species Tifton 85 (*Cynodon* spp.) was studied in a mob-stocking (Allen et al., 2011) grazing system, in which each paddock was stocked at a high rate for one day and then allowed to rest for 19 days.

The experiment was conducted using a completely randomized design with five replicates (the number of forage cuts in each season) and the four seasons (fall, winter, spring and summer) as treatments.

During the dry period, which begins in May, a sprinkler irrigation system was used with a microsprinkler in each paddock. The irrigation regime was determined according to the needs of the plants to recovery its leaf area correlated with the height of the animals' entrance. The irrigation was conducted every four days for a total of 6.5 hours per day from May to October 2014, using a 30-mm water blade.

The dry matter (DM) production and the nutritional value of Tifton 85 were evaluated each season (summer, fall, winter and spring) for a year. The rainfall and mean monthly temperature were also monitored during this period (Figure 1).

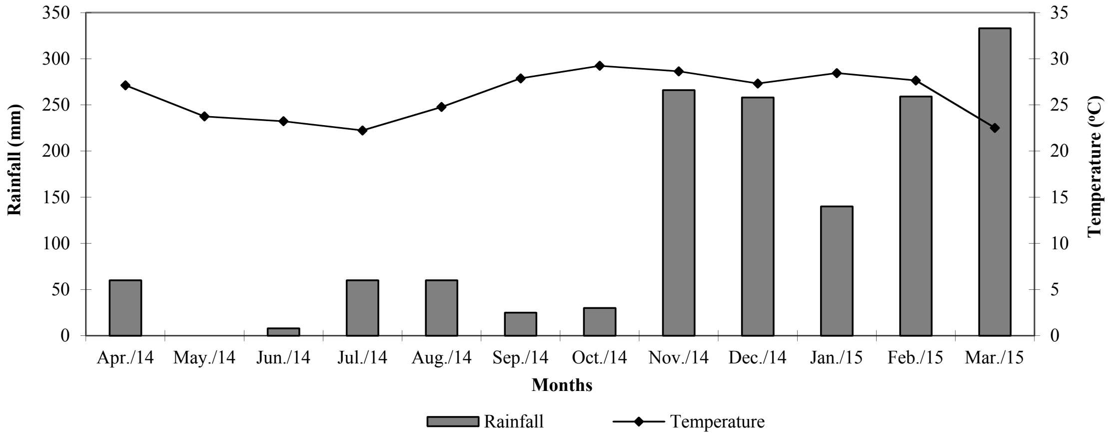

Figure 1. Rainfall (mm) and mean temperature (°C) in Santa Helena de Goiás, GO, Brazil, from April 2014 to March 2015

2.2 Forage Production and Quality

The grass was evaluated under a successive-cut regimen, with cutting every 19 days at a residual height of 5 cm, which averaged three samples per season. Estimates of total dry matter (TDM) in kg DM ha^{-1} were obtained by collecting two forage samples (1 m^2) per paddock, according to the mass evaluation protocol, at points representative of the average sward height (Silva et al., 2013). Because of the limited areas of the paddocks, two representative points were sampled per paddock to avoid damaging the pasture structure through successive collections. Subsequently, the samples were manually separated into two fractions, leaf blade and stem + sheath.

The fresh material was immediately weighed and sent to the laboratory for further DM estimation, where it was predried in a forced air circulation oven at approximately 55 °C. Next, the samples were ground with a 1-mm sieve in a Wiley-type mill and stored in plastic jars for analysis.

The chemical and bromatological analyses for nutritional value of Tifton 85 were performed to determine for (DM) dry matter (Method 934.01); (CP) crude protein obtained by determining total N, using the micro-Kjeldahl technique (Method 920.87) and fixed conversion factor (6.25); (EE) ether extract content, determined gravimetrically after extraction with petroleum ether in a Goldfish device (Method 920.85) according to AOAC. The (NDF) neutral detergent fiber according to Mertens (2002); (ADF) acid detergent fiber (Method 973.18; AOAC, 1990). The total digestible nutrient (TDN) was obtained using the equation (% TDN = 105.2 – 0.68 (% NDF)), proposed by Chandler (1990). For *in vitro* dry matter digestibility (IVDMD), we adopted the technique described by Tilley and Terry (1963) adapted to the artificial rumen, developed by ANKON® using the "Daisy incubator" of Ankom Technology.

2.3 Milk Production and Quality

There were 19 paddocks (800 m^2 each) on the farm, and the stocking rate was 12 animal units (AU) of Holstein cows with a mean live weight of 560±36.8 kg, multiparous and with four years on average, during the rainy season and 6 AU during the dry season. The cows were allocated according to the stage of lactation, producing satisfactorily. The calves were separated from the mothers after birth.

The cows were milked twice daily to evaluate milk production and quality. The first milking started at 6:00 am, and the second began at 4:00 pm; the milk samples were collected at the first milking. Before milking, the cows were supplemented with 4 kg of energy concentrate in the form of corn grit with a mineral supplement (13 to 14% calcium and 9% phosphorus). The milking parlor was herringbone shaped (5 × 2 m) in a closed circuit and contained a high-line milk piping system, a series of feeders, a central pit, four individual milking sets and milk meters.

The milk samples (200 ml each sample) were collected every 19 days on the same day as the forage production and quality evaluations. These analyses were performed throughout all of the seasons.

At milking, the first three jets were collected in a black-bottom mug to test for clinical mastitis, and milk was not collected from the animals that tested positive. Next, the udders were dipped in a 5% iodine solution (predipping), completely dried using paper towels and then attached to a set of teat cups. After complete and uninterrupted milking, the teat cups were removed, and the udders were immersed in 5% iodine solution (postdipping) before the animals were released for grazing.

The milk samples were obtained at the end of milking using individual meters equipped with a bottom valve, which was kept in the "stir" position for five seconds to homogenize the milk sample before collection.

2.4 Milk Chemical Analyses

Flasks (40 mL) containing Bronopol® preservative were used for the chemical composition analyses and somatic cell counts (SCCs), and Azidiol® was used for the total bacterial counts (TBCs), which were conducted according to IDF (2006) using flow cytometry with the results expressed in SC mL^{-1}. Prior to analysis, the flasks were marked with a barcode corresponding to the number of each animal. The milk volume (M) produced by each animal was also measured.

Fat, protein, lactose, total dry extract (TDE) and nonfat dry extract (NDE) were determined according to the methodology proposed by the IDF (2000), and the results were expressed as a percentage (%). The urea (mg dL^{-1}) and casein levels (%) were determined by differential absorption using both Fourier transform infrared (FTIR) spectroscopy and LactoScope equipment (Delta Instruments).

2.5 Statistical Analyses

The data for each parameter were subjected to analysis of variance using the ExpDes package (Ferreira et al., 2014) in program R (version R-3.1.1) (2014), and Tukey's test was used to compare the means. The Pearson coefficient was estimated, and its statistical significance was validated by Student's t-test using the color.test function of program R to determine the associations between the variables. A probability level of 5% was considered significant in all tests.

3. Results and Discussion

3.1 Forage Production and Quality

The results showed a significant effect ($P < 0.05$) of season on the production and nutritional characteristics of Tifton 85 pasture grass. For the total dry matter (TDM) production of forage, Table 1 shows that the lowest production was obtained during the winter, indicating that the production potential of this forage is limited even with winter irrigation and that a direct response to environmental variables exists. Herrera and Hernandez (1989) reported that tropical forages require not only good soil management but also adequate amounts of water, temperature, and light for soil microorganisms to develop adequately.

The forage production during the summer was 59.56 and 19.71% higher than that during the winter and fall, respectively. Such an effect was expected, considering that grasses of the genus *Cynodon* are considered tropical forage grasses. The increases in temperature and rainfall, as shown in Figure 1, explain the increase in TDM during the spring and summer. Although an irrigation system was used, the lower temperatures and decreased daylight hours during the fall and winter (Figure 1) explain the decrease in TDM production during these periods (Table 1).

Table 1. Total dry matter (TDM) production, leaf blade/stem (LB/S) ratio, chemical composition, and in vitro dry matter digestibility (IVDMD) of Tifton 85 grass during different seasons

Characteristic	Season				CV (%)
	Fall	Winter	Spring	Summer	
TDM (kg ha^{-1})	4497 b	3265 c	3839 b	5601 a	19.68
LB/S	2.25 b	1.28 c	2.88 a	3.10 a	18.56
CP (%)	17.41 a	15.42 b	17.42 a	18.45 a	7.01
NDF (%)	65.65 bc	71.18 a	68.10 b	63.02 c	3.54
ADF (%)	35.19 b	39.63 a	34.01 bc	32.45 c	5.64
IVDMD (%)	65.39 b	62.22 c	68.59 a	68.89 a	5.06
EE (%)	2.23 a	2.09 b	2.25 a	2.30 a	13.03
TDN (%)	65.65 a	61.18 b	64.13 a	63.02 a	7.45

Note. Means within rows followed by the same letter do not differ from each other by an F test at the 5% probability level. CP: crude protein; NDF: neutral detergent fiber; ADF: acid detergent fiber; EE: ether extract; TDN: total digestible nutrients.

Ladeira, Galzerano, Reis, and Ruggieri (2013), working with three different indices of residual leaf area in Tifton 85 pastures, obtained a mean production of 5,074 kg DM ha^{-1} from January to March, corroborating the TDM data (5,601 kg DM ha^{-1}) obtained in the present study (Table 1).

The leaf blade/stem (LB/S) ratio, with a 58.7% decrease from summer to winter, followed a seasonal behavior similar to that of TDM. The LB/S ratio was 27.41% higher during the summer compared with the fall. These results lead imply that weather affected the morphological characteristics of the grass. During the winter, the weather conditions were unfavorable for the production of tropical forages such as Tifton 85. Although the experimental site was irrigated, factors such as the amount and quality of light and temperature (Figure 1) directly affected the plants. The reproductive stage began under these conditions, increasing stem elongation, leading to a decrease in the LB/S ratio, as shown in Table 1. The increase in stem production compared with leaf production is directly reflected in the plant architecture. Under these conditions, the amount and quality of light that reaches inside the canopy is lower, directly impacting the quality of the TDM available to the animals.

The CP levels of the forage (Table 1) were similar during the fall, spring, and summer ($P > 0.05$), only showing a lower value during the winter. These results are due to better weather conditions that contributed to greater development of the leaf blade and stem fractions in relation to higher light interception during the nonwinter seasons. The CP levels reached 17.76% during these seasons compared with 15.42% during the winter.

Regarding the milk chemical composition and the consumption and digestibility of managed tropical forage in an intermittent grazing system from January to May, Porto, Deresz, Santos, and Lopes (2009) found CP levels of 18.5% for star grass (*Cynodon nlemfuensis*), a value very close to that obtained during the summer in the present study. Marchesan et al. (2013), assessing the production and chemical composition of Tifton 85 under continuous grazing during the winter, observed mean CP levels of 14.34%, similar to that obtained during the winter in the present study.

The highest NDF and ADF levels were obtained during the winter (Table 1) due to the low-temperature-induced decrease in tillering and in new leaves during this period (Figure 1). This decrease is directly reflected in the higher proportion of stems, thus increasing the fibrous fractions, which makes CP inaccessible to rumen microorganisms (Velásquez et al., 2010; Moreira et al., 2012). The lowest values were observed during the summer, followed by the spring and fall.

IVDMD was also affected ($P < 0.05$) by season, and the weather interfered with forage digestibility. The highest IVDMD values occurred during the summer months (Table 1), when leaf production and digestibility were higher (Table 1) due to weather-related factors favorable to forage production. These leaf properties also explain the occurrence of the highest CP levels during the same period. Because of a lower amount of structural carbohydrates, rumen microorganisms had greater access to better-quality CP levels, leading to an increase in feed digestibility, with the lower ADF levels acting to improve forage digestibility.

As the mob-stocking grazing system was adopted at the farm level, working with a high stocking rate within a short duration of time favored good-quality pasture material, considering that there is higher pseudostem removal under these conditions. This removal ensures that the pseudostems present in the forage mass of this stratum are younger and consequently contain higher CP and lower fibrous fraction contents (Cecato et al., 1985).

Table 1 shows that the lowest value for both the EE and TDN contents was obtained during the winter and differed ($P < 0.05$) from the fall, spring, and summer values, which averaged 2.26 and 64.22% for the EE and TDN contents, respectively. The TDN content is important because energy and protein are frequently the most limiting factors for ruminants (Oliveira et al., 2010). In this sense, the increase in EE and TDN levels during the seasons with better weather conditions can be inferred to promote a better use of forage by animals, thus leading to higher energy intake and consequently better performance for dairy cows.

Cappelle, Valadares Filho, Silva, and Cecon (2001) reported that estimated energy values of feeds and diets are important for high-production animals that require large amounts of energy. Energy-deficient diets reduce milk production, cause excessive weight loss and reproductive problems, and can reduce disease resistance.

3.2 Milk Production and Quality

Season significantly affected ($P < 0.05$) milk production and the fat, protein, lactose, SCC, TBC, urea, and casein values. However, the TDE and NDE values remained unaffected by season (Table 2).

Table 2. Milk production and quality of Holstein cows under intermittent grazing on Tifton 85 during different seasons

Characteristic	Season				CV (%)
	Fall	Winter	Spring	Summer	
Milk production (kg)	15.95 b	13.67 c	16.97 a	17.99 a	3.68
Fat (%)	4.12 a	3.21 b	3.49 b	4.04 a	10.80
Protein (%)	3.25 a	2.83 b	3.12 a	3.29 a	5.38
Lactose (%)	4.97 ab	4.44 b	5.26 a	5.23 a	11.92
TDE (%)	12.52 a	12.28 a	12.08 a	12.66 a	0.50
NDE (%)	8.31 a	8.21 a	8.58 a	8.65 a	3.68
SCC (x1000 SC mL^{-1})	156.3 b	132.7 c	251.5 a	267.1 a	10.85
TBC (x1000 CFU mL^{-1})	23.02 b	22.70 c	24.17 a	23.31 a	5.38
MUN (mg dL^{-1})	16.00 a	12.55 c	13.97 b	15.79 a	11.92
Casein (%)	2.44 b	2.23 c	2.51 a	2.53 a	0.52

Note. Means within rows followed by different letters differ from each other by an F test at the 5% probability level. TDE: total dry extract; NDE: nonfat dry extract; SCC: somatic cell count; TBC: total bacterial count; MUN: milk urea nitrogen.

The Table 2 shows that milk production was higher during the spring and summer, which can be attributed to the direct effect of forage quality on milk production and quality. The weather conditions were conducive to forage production (Tifton 85 grass) during the spring and summer months, and consequently, the best forage nutritional values occurred during this period, mainly regarding CP and IVDMD (Table 1). Thus, the animals had access to better-quality forage, explaining the increase in daily milk production and milk solids.

The milk production obtained during the spring and summer corroborate the values obtained by Vilela et al. (2006), who observed production ranging from 12.0 to 19.1 kg of milk per cow day in Holstein cows managed in irrigated coastcross pastures supplemented with 3 kg of concentrate. Similarly, Teixeira, Jayme, Sene, and Fernandes (2013) obtained a mean production of 15.0 kg of milk per cow day in irrigated Tifton 85 pastures.

Milk production was significant even during the winter, with a 27.87% decrease compared with the mean production obtained during the spring and summer. These results are due to the use of irrigation, which favored forage production during the winter, when most tropical and subtropical conditions favor the seasonal production of forage plants.

The fat levels were higher during the fall and summer ($P < 0.05$), with a mean of 4.08% (Table 2), a value slightly higher than the 3.8% observed by Porto et al. (2009). The NDF levels are directly related to the amount of fat in milk, considering that the degradation of fiber in the rumen produces acetate, which is the primary precursor for the synthesis of milk fat (Bargo et al., 2003; Porto et al., 2009).

The low NDF and ADF levels during the spring and summer (Table 1) explain the higher percentages of fat in the milk during these periods because of microbial access to better-quality fiber. Research by Deitos, Maggioni, and Roemro (2010) reported that environmental and genetic features as well as nutritional management may strongly affect the fat composition of milk because these features directly influence the total solids. The same explanation is applicable to lactose levels, considering that rumen microorganisms use structural and nonstructural carbohydrates to produce glucose, which is used by the mammary glands to synthesize lactose.

The mean protein content of the milk was highest during the summer and fall ($P < 0.05$) at 3.27% (Table 2). Porto et al. (2009) obtained a mean of 2.7% during the summer, lower than that observed in the present study. Greater attention should be paid to animal supplementation with amino acids and glucose to maximize milk protein synthesis under a production system based entirely on pasture, where the levels of certain amino acids are low (Bequette et al., 1998; Porto et al., 2009).

During the winter, the protein content of the milk (2.83%) was slightly below the minimum value required by Ministério da Agricultura, Pecuária e Abastecimento (2011) for receiving refrigerated milk from processing industries. These results are correlated with the lower protein value of Tifton 85 grass during the same period.

The highest mean lactose values were obtained during the spring and summer, followed by the fall. Higher milk production was also observed during these periods, which reinforces the premise that lactose is the main osmotic regulator of milk production; thus, higher lactose levels correspond to higher milk volumes (Zanela et al., 2006).

This sentence Rosa, Trentin, Pessoa, Silva, and Rubin (2012) observed a mean value of 4.37% over all the seasons for samples from Holstein, Jersey, and crossbred dairy cows, a mean lower than that obtained in the present study (5.15%) for the fall, spring, and summer.

The TDE and NDE values were similar among the seasons studied, with means of 12.38 and 8.43%, respectively. However, Gonzalez (2004) observed that the months of the year affected both the chemical composition of milk, which was associated with variation in food availability and quality, and the incidence of mastitis, which was associated with weather conditions favorable for microorganisms.

Table 2 shows that the highest SCCs were obtained during the spring and summer, followed by the fall and winter. These results corroborate the data of Gonzalez et al. (2004), who showed that excessive rainfall promotes higher mastitis rates. By contrast, Andrade et al. (2014) reported no effect of season on SCCs in an evaluation of milk from commercial cattle herds within the rugged region of Rio Grande do Norte State, Brazil.

Environmental factors such as high temperature and moisture content are noteworthy in that they provide favorable conditions for microorganisms to proliferate, and greater care should be taken with hygiene in milking and animal management during production under such conditions.

The mean SCC values during all the seasons met the 500,000 SC mL^{-1} maximum limit that is currently allowed to receive raw milk, according to the recommendations in Ministério da Agricultura, Pecuária e Abastecimento (2011). Higher counts indicate the incidence of subclinical and clinical mastitis. Silva et al. (2014) obtained higher SCC results than those observed in the present study, with a mean SCC of 604,000 SC mL^{-1} and significant variation during the dry (558,000 SC mL^{-1}) and rainy seasons (650,000 SC mL^{-1}).

The mean TBC results exhibited the same behavior as the SCC results (Table 2) during the periods of highest rainfall (spring and summer), when higher counts were obtained. TBCs indicate the hygienic conditions of milk production, with values above 300,000 CFU mL^{-1} outside the accepted range in Ministério da Agricultura, Pecuária e Abastecimento (2011) for receiving refrigerated milk.

The mean urea nitrogen values in the milk were highest during the fall and summer, followed by the spring and winter (Table 2). According to Chizzotti et al. (2007), urea levels are correlated with rumen ammonia concentrations, which can improve the protein balance in diets. However, the optimal urea nitrogen concentration in milk varies with the level of milk production. The urea content results for the milk of the Holstein dairy cows used in the present study are within the recommended range for milk (Table 2). Then Jonker, Kohn, and Erdman (1999) reported that the urea nitrogen concentration in milk should vary from 10 to 16 mg dL^{-1}, depending on the production level, because values above this limit may indicate a high nitrogen intake or an excess of degradable protein in the rumen.

Casein is the milk component of highest interest from the standpoint of commercial processing because its concentration is directly related to the manufacturing yield of dairy derivatives. The casein results (Table 2) followed the same behavior as those for milk production, contradicting the premise that an increase in milk components occurs with decreasing production. The highest values were obtained during the spring and summer due to the better weather conditions observed during this period for grass development and consequently better forage availability for the animals.

3.3 Correlation of Forage Production and Quality with Milk Production and Quality

According to Table 3, forage production and quality directly affected milk production and quality. A positive correlation occurred among the production of TDM, CP, IVDMD, fat, protein, and lactose, inferring that an increased offering of better-quality forage increased milk production and quality, without a significant decrease in milk solids.

Table 3. Correlation coefficients relating forage production and quality with milk production and quality in Holstein cows under intermittent grazing on Tifton 85.

Milk variable	**Forage variable**				
	DM production	**NDF**	**ADF**	**CP**	**IVDMD**
Milk production	0.3272	-0.2666	-0.5903	0.448	0.3313
Fat	0.6046	-0.5218	-0.3607	0.2271	0.1547
Protein	0.649	-0.6136	-0.5551	0.4785	0.1813
Lactose	0.5041	-0.223	-0.3895	0.4271	0.1899
TDE	0.0571	-0.5997	-0.2745	0.3602	0.1641
NDE	0.4876	-0.3742	-0.2346	0.2523	0.181
SCC	0.5725	-0.458	-0.6993	0.5727	0.6086
TBC	0.1577	0.0126	-0.3667	0.3057	0.2384
Urea	0.678	-0.4661	-0.4588	0.5144	0.2537
Casein	0.4172	-0.3128	-0.5532	0.3932	0.4659

Note. TDE: total dry extract; NDE: nonfat dry extract; SCC: somatic cell count; TBC: total bacterial count; NDF: neutral detergent fiber; ADF: acid detergent fiber; CP: crude protein; IVDMD: in vitro dry matter digestibility

The increased TDM production with a higher proportion of leaves (Table 1) led to better-quality material and higher rumen digestibility. This conclusion follows from the negative correlation of NDF and ADF with all the parameters used to evaluate the milk quality (Table 3), *i.e.*, there was increased milk production and quality with decreasing fiber levels.

These results show the importance of providing good-quality pastures for animals with high production potential. Considering that most Brazilian milk production occurs on pastures, where feed is less expensive and management more economical, the provision of good-quality pastures can have a significant impact on a small rural property (Quaresma et al., 2011).

Marchesan et al. (2013) reported that for satisfactory animal behavior, feed with a nutritional value adequate to meet the needs of production animals must be offered, thus optimizing the production system and obtaining satisfactory growth rates.

4. Conclusion

The Tifton 85 was efficient for the production of good-quality forage. However, the weather was the predominant determinant of grass quality, and irrigation was an option to maintain dairy yield throughout the year.

The milk production of Holstein cows on pasture under an intermittent grazing regimen is satisfactory during the fall, spring, and summer. The forage exhibited limited production during the Brazilian winter, which was directly reflected in the milk yield. A reduction in the stocking rate or increase in the number of paddocks is advisable during the winter to maximize dairy production without compromising forage development.

The correlation data showed the importance of consuming better-quality forage for increasing milk production without compromising the levels of milk solids.

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