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Nitrogen and carbohydrate fractions in exclusive Tifton 85 and in pasture oversown with annual winter forage species

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ABSTRACT. The experiment was undertaken at the Faculty of Agrarian and Veterinary Sciences (FCAV) Jaboticabal, São Paulo State, Brazil, during winter-spring-summer of 2001-2002, to determine the fractionation of nitrogen and carbohydrates in Tifton 85 (*Cynodon dactylon* Vanderyst x *Cynodon nlemfuensis* (L.) Pers), exclusively or oversown with winter annual forage species. Treatments comprised bristle oat (*Avena strigosa* Schreb), yellow oat (*Avena byzantina* C. Koch), triticale (*X Triticosecale* Wittmack), bristle oat + yellow oat, bristle oat + triticale, yellow oat + triticale, bristle oat + yellow oat + triticale seeded in Tifton 85 and sole crop (control). Experimental design was composed of completely randomized blocks with three replications. Fodder was cut 20 cm high (presence of winter forage) and 10 cm high (Tifton 85 pasture). Crude protein, total carbohydrate and the fractions of nitrogen compounds and carbohydrates were determined. Decrease was reported in the levels of chemical compounds in winter forage species and in Tifton 85 during the evaluation periods. The content of nitrogen compounds and carbohydrates varied widely during the evaluation period according to the morphological characteristics of grass species and botanical composition of pastures.

Keywords: *Avena* sp., *Cynodon* sp., grassland management, tillage, triticale.

Fracionamento do nitrogênio e dos carboidratos de Tifton 85 exclusivo ou sobressemeado com forrageiras anuais

RESUMO. O experimento foi conduzido na FCAV – Campus de Jaboticabal, no período de inverno-primavera-verão de 2001-2002, com o objetivo de determinar o fracionamento de compostos nitrogenados e de carboidratos do Tifton 85 (*Cynodon nlemfuensis* Vanderyst x *Cynodon dactylon* (L.) Pers), exclusivo ou sobressemeado com forrageiras anuais de inverno. Os tratamentos testados foram: aveia preta (*Avena strigosa* Schreb); aveia amarela (*Avena byzantina* C. Koch); triticale (*X Triticosecale* Wittmack); aveia preta + aveia amarela; aveia preta + triticale; aveia amarela + triticale; aveia preta + aveia amarela + triticale, sobressemeados sobre Tifton 85 e, sem consorciação (testemunha). O delineamento experimental utilizado foi o de blocos completos ao acaso, com três repetições. O corte das forrageiras foi realizado a 20 cm de altura (presença de forrageiras de inverno) e 10 cm de altura (ausência das forrageiras de inverno). Foram determinados os teores de proteína bruta, carboidratos totais, e o fracionamento dos compostos nitrogenados e de carboidratos. Houve redução nos teores dos compostos químicos das espécies de forrageiras de inverno e no Tifton 85 ao longo dos períodos de avaliações. Os conteúdos de compostos nitrogenados e de carboidratos apresentaram grande variação durante os períodos avaliados, relacionando com as características morfológicas das espécies de gramineas e com a composição botânica das pastagens.

Palavras-chave: *Avena* sp., *Cynodon* sp., manejo de pastagens, plantio direto, triticale.

Introduction

Tropical foragers have low nutrition rates when compared to species in temperate climates (MINSON, 1990). During the winter period the former are either dormant or only slightly productive. However, the inclusion of temperate climate grasses through oversowing to tropical pastures during the winter period increases the capacity of animal performance improvement if it is accompanied by adequate management (ANIL et al., 1998).

Forager plants' chemical composition is one of the parameters used to assess their nutrition rate. Literature abounds with reports on badly managed foragers' low nutrition rates which are associated with decreasing rates of crude protein and minerals and with high fiber levels (lignin, cellulose, hemicellulose, cuticle and silica), with digestibility reduction (VAN SOEST, 1994).

Sniffen et al. (1992) suggest that feed taken by ruminant animals should be fractioned for adequate digestion of carbohydrates and proteins by the rumen, with maximum performance of rumen microorganisms. This occurs due to the minimization of energy and nitrogenated losses in the rumen.

The determination of protein and carbohydrate fractions and rumen kinetics of certain feed in ruminants was undertaken by Malafaia et al. (1997, 1998). These authors reported reported that pasture grass Tifton 85, harvested at approximately 60 days with 10.2% CP and 79.6% total carbohydrates, had proportions of 17.3, 2.5, 36.1, 26.9 and 16.9% in protein fractions A, B1, B2, B3 and C, as percentages of total crude protein, and 5.5, 74.4 and 20.2%, in carbohydrate fractions A+B1, B2 and C as percentages of total carbohydrate rates, respectively.

When they evaluated feed protein fractions, Cabral et al. (2000a and b) reported fraction proportions of A, B1, B2, B3 and C with 12.3 and 26.8; 9.1 and 4.0; 29.3 and 23.5; 40.8 and 34.2; and 8.2 and 11.4% as a percentage of total crude protein in Tifton 85 harvested at a height of 30 (14.6% crude protein) and 50 cm (9.9% crude protein), respectively. The above authors reported fraction proportions of carbohydrates of A+B1, B2 and C with 14.6 and 11.8; 68.7 and 68.7; and 16.6 and 19.3% as percentages of total carbohydrates in Tifton 85 harvested at a height of 30 (78.1% carbohydrates) and 50 cm (81.4% carbohydrates), respectively.

The composition of crude protein, total carbohydrates and fractioning of nitrogenated compounds and of carbohydrates in Tifton 85 alone and oversown with winter forager grass were evaluated.

Material and methods

The experiment was undertaken at the Forage Culture Sector of FCAV-UNESP, Jaboticabal, São Paulo State, Brazil, in an approximately 1,300 m^2 area, featuring Dystrophic Deep Red Latisol clayey soil made up of 24 lots with 40 m^2 each arranged in three blocks.

Winter forager species introduced in pasture composed of Tifton 85 (*Cynodon nlemfuensis* Vanderyst x *Cynodon dactylon* (L.) Pers) were: bristle oats (*Avena strigosa* Schreb) cv. common, yellow oats (*Avena byzantina* C. Koch) cv. São Carlos and triticale (*x Triticosecale* Wittmack) cv. CB02.

Eight treatments were tested: AP: bristle oats; AA: yellow oats; T: triticale; AP+AA: bristle oats + yellow oats; AP+T: bristle oats + triticale; AA+T: yellow oats + triticale; AP+AA+T: bristle oats + yellow oats + triticale, oversown in an area with Tifton 85; and T-85: treatment control (an area exclusively with Tifton 85).

Winter forage was introduced on the 29^{th} May 2001 after lowering of Tifton 85 to 5 cm in height. All material cut for hay was also removed. Oversowing of winter annual plants and manuring occurred on the 30^{th} May 2001.

Oversowing was undertaken with direct plant seeding, space 22.5 cm between rows, and the following quantity of seeds used: 60 kg ha^{-1} bristle and yellow oats and 40 kg ha^{-1} triticale. Germination (%) and purity degree (%) for bristle oats, yellow oats and triticale were 86 and 97; 92 and 98; 81 and 97, respectively. They were proportionally calculated by seeding density in treatments with mixtures of winter foragers. Chemical analysis results for the experimental area were pH in $CaCl_2$ = 5.4; MO = 29 g dm^{-3}; P = 17 mg dm^{-3}; K = 5.4 mmol dm^{-3}; Ca^{2+} = 38 mmol dm^{-3}; Mg^{2+} = 14 mmol dm^{-3}; H+Al = 28 mmol dm^{-3}. Initial manure consisted of 30 kg ha^{-1} nitrogen (urea); 60 kg ha^{-1} P_2O_5 (simple superphosphate) and 60 kg ha^{-1} K_2O (potassium chlorate) mixed on sowing. Covering manuring with 40 kg ha^{-1} nitrogen and 40 kg ha^{-1} K_2O were mixed and manually distributed after 30 days of oversowing and using the same manure sources previously mentioned.

The Agro-meteorological Station of the Department of Exact Sciences provided the meteorological data, data on maximum and minimum temperatures and rainfall during the experimental period, used in current analysis (Table 1).

Table 1. Monthly rainfall (mm) and maximum and minimum temperatures (°C) during the experimental period.

Month	Rainfall	Maximum temperature	Minimum temperature
May	92	26.6	14.0
June	5	26.3	12.9
July	2.6	28.1	13.2
August	61	28.9	14.0
September	27.3	29.7	16.4
October	149.3	30.4	17.7
November	222.7	30.7	19.7
December	269.3	29.4	19.2
January	404.3	30.0	19.7

Agro-climatologic Station/ Dep. of Exact Sciences FCAV/Unesp (2000).

Further, a 15 mm aspersion irrigation was employed weekly in the experimental area from sowing time up to September to warrant the proper formation of winter foragers and their re-spouting. Irrigation was quantified according to data in previous experiments undertaken in the Forage Culture Sector of the FCAV-Unesp.

Pastures were managed according to rotational lot system with an evaluation of forage mass and start of pasture when plants reached a height of 55 - 60 cm with winter foragers. Pasture evaluation exclusively with Tifton 85 was undertaken when plants were 35 - 40 cm high. The animals stayed on the area till residual grass height reached 20 cm (presence of winter forage) and 10 cm (after the removal of winter forage) so that plant's re-spouting mechanisms would be maintained.

Foragers were evaluated by the manual cutting of plants contained in 1 m^2, at 20 cm height for the first, second and third growth periods, and at 10 cm height for the fourth and fifth growth periods. After the collection of material, the experimental area, limited by an electric hedge, was divided into bands and Dutch dairy cows, used as pasture tools, lowered the forager plants. When the animals were removed, 40 kg ha^{-1} nitrogen (urea) were used for cover manuring in all growth periods.

Five evaluations were undertaken with the following growth periods (GP): GP1: 5/30 to 7/27 (59 days); PC2: 7/28 to 9/10 (45 days); PC3: 9/11 to 10/19 (39 days), PC4: 10/20 to 11/19 (31 days), PC5: 11/20 to 1/10 (52 days).

Harvested forage was sent to the Forage Culture Laboratory and weighed; a sample of each fraction was retrieved and dried in an air buffer at 60ºC. Samples were then ground in a Willey grinder and sieved in a 1 mm mesh.

Crude protein rates were estimated by total nitrogen multiplied by 6.25, according to AOAC (1995). Fractioning of nitrogenated compounds followed Licitra et al. (1996).

Carbohydrate fractions in samples were analyzed following Sniffen et al. (1992): total carbohydrate (TC) rates were estimated after the determination of total nitrogen, ethereal extract and mineral matter rates (AOAC, 1995) and then calculated according to methodology by Sniffen et al. (1992). Non-fiber carbohydrates (fractions A + B1) were calculated following Valadares Filho et al. (2006). Calculation of fractions B2 and C, respectively fiber in neutral detergent potentially digestible and non-digestible, was undertaken according to Sniffen et al. (1992).

Nutrient rates of total mass (winter foragers + Tifton 85) of all treatments were estimated by the proportion winter forager and Tifton 85 multiplied by nutrient rate (MOREIRA et al., 2005), in which % of total nutrient = % of winter foragers x % nutrient + % Tifton 85 x % nutrient.

Whereas experimental design consisted of randomized blocks with three repetitions, experimental data underwent MIXED statistical analysis (Statistical Analysis System) (SAS, 1990) and Repeated Measures, according to Littell et al. (1998). Minimum square method was employed for means (LSMEANS), whereas test F, at the significance level of 10%, was used to compare means between treatments.

Results and discussion

Table 2 shows crude protein rates (CP). No significant differences ($p > 0.10$) were found in the interaction between forager plants and growth periods. Significant differences ($p < 0.10$) occurred during the growth periods with highest CP rates in the first growth period (17.8%), when compared to the others. This fact was due to the winter foragers in the pasture.

No significant difference in CP rates occurred during the second, third and fourth growth periods. However, a low CP rate in all treatments was reported in the fifth period, with mean 11.4%.

CP rates decreased because of the removal of winter foragers throughout the evaluations and also due to changes in botanic composition, vegetal structure and leaf-stem relationship which changed throughout the evaluations, as reported by Moreira et al. (2005), with a decrease in CP rates.

Table 2. Crude protein rates (%) in exclusive pastures Tifton 85 oversown with winter foragers.

Treatments	Periods of the year and growth periods					Mean
	5/30 to 7/27 59 days	7/28 to 9/10 45 days	9/11 to 10/19 39 days	10/20 to 11/19 31 days	11/20 to 1/10 52 days	
AP	18.7	13.2	13.6	14.0	11.4	14.2
AA	16.0	13.9	13.7	13.8	12.4	13.9
T	18.4	13.2	14.9	12.9	11.9	14.3
AP + AA	18.1	13.8	14.3	13.6	11.8	14.3
AP + T	20.3	14.0	12.9	13.4	10.4	14.2
AA + T	17.6	13.9	13.3	13.3	10.0	13.6
AP+AA+T	17.0	15.0	14.1	14.3	13.2	14.7
T-85	16.2	14.1	14.2	12.4	10.5	13.5
Mean	17.8 a	13.9 b	13.9 b	13.5 b	11.4 c	

Means followed by small letters in the row differ among themselves ($p > 0.10$). AP: bristle oats; AA: yellow oats; T: triticale; T-85: Tifton-85.

CP rates in bristle and yellow oats and in triticale decreased in proportion to the growth period (Table 2) owing to the reduction of winter forager plants and their alterations in botanic composition.

Mean CP rates in all treatments and in different growth periods are higher than the minimum 7% rate registered by Minson (1990) so that nitrogen supplementation provided to rumen microorganisms could be had and thus warranting the maintenance of the animals.

Table 3 shows that great variations, affected by nitrogen rates in each forager plant, by botanic composition and by leaf-stem relationship, have been registered with regard to fractions of nitrogenated compounds in all evaluations (MOREIRA et al., 2005).

The proportion of non-protein nitrogen (NPN) in fraction A varied from 20.8 (first growth period) in pasture bristle oats + triticale, to 51.4% (fourth growth period) in triticale pasture (Table3). High rate of A in grass may be due to nitrogenated manure. In fact, Camargos et al. (2006) reports that nitrate is absolved by the roots and may be reduced or stored in the vacuoles or displaced to the aerial part where it is reduced or stored in the leaf vacuoles when nitrogen availability occurs in the soil. In cytosol, nitrate is reduced to nitrite which enters the plastids. After reduced to ammonia, it becomes the substrate for the synthesis of amino-acids, glutamine and glutamate which, in their turn, foreground the synthesis of other amino-acids required for the formation of proteins and thus the foliar development in the plant.

The high proportion of soluble nitrogen (faction A) in forage may cause great nitrogen losses through ammonia. Although it may be recycled in the rumen, a great quantity may be metabolized and removed from the organism. Loss of energy, called urea liability, occurs in the process (OWENS; ZINN, 1988). Urea may be recycled in the rumen either through saliva or the rumen wall. The less the crude protein rate in the diet the higher is nitrogen recycling as urea from the liver to the rumen through the ammonia. Owens and Zinn (1988) found that in diets with 5 to 20% crude protein, recycling ranged between 70 and 11% of nitrogen intake and between 23 and 92% of urea recycled in the rumen, respectively.

The proportion of soluble nitrogen which degraded fast in the rumen (fraction B1), varied between 5.3 (third growth period) in the pasturing of yellow oats and 16.2% (second growth period) in the pasturing of yellow oats (Table 3).

Table 3. Proportion of nitrogenated fractions, in percentage of total nitrogen (% TN), of exclusive pastures Tifton 85 and oversown with winter foragers.

Fraction	Treatments								Mean
	AP	AA	T	AP+AA	AP+T	AA+T	AP+AA+T	T-85	
				1st growth period (5/30 to 7/27 – 59 days)					
A	24.0 b	28.9 ab	31.2 a	28.1 ab	20.8 c	32.7 a	25.2 b	31.3 a	27.8
B1	13.6 a	8.8 b	9.5 b	7.9 bc	12.9 a	12.3 a	10.9 b	6.5 c	10.3
B2	26.7 a	17.3 c	13.7 d	20.5 b	21.4 b	17.6 c	20.5 b	20.1 b	19.7
B3	20.2 c	28.9 ab	30.0 a	31.7 a	33.8 a	22.7 c	28.9 ab	29.4 ab	28.2
C	15.5 a	16.1 a	15.6 a	11.8 c	11.1 c	14.7 ab	14.5 ab	12.7 c	14.0
				2nd growth period (7/28 to 9/10 – 45 days)					
A	31.0 c	35.3 b	34.4 bc	37.6 a	42.8 a	35.9 b	34.3 bc	40.8 ab	36.5
B1	15.2 ab	16.2 a	11.1 b	12.9 b	11.6 b	12.7 b	10.9 b	11.9 b	12.8
B2	15.8 ab	15.9 ab	18.5 a	14.1 ab	11.0 b	11.9 b	12.1 b	11.8 b	13.9
B3	14.3 b	11.7 c	11.2 c	14.8 b	9.7 c	13.9 b	18.3 a	12.4 bc	13.3
C	23.7 ab	20.9 ab	24.8 a	20.6 ab	24.9 a	25.6 a	24.4 a	23.1 ab	23.5
				3rd growth period (9/11 to 10/19 – 39 days)					
A	39.6 a	37.2 ab	36.7 ab	33.9 b	32.6 b	37.6 ab	37.7 ab	33.3 b	36.1
B1	7.7 c	13.1 ab	12.3 b	12.7 b	14.9 a	14.6 a	10.3 bc	13.3 ab	12.3
B2	20.1 a	10.7 c	14.3 b	14.3 b	14.3 b	10.0 c	10.7 c	15.1 b	13.7
B3	7.8 c	12.0 b	13.9 ab	14.3 a	12.6 b	11.3 b	13.2 ab	13.2 ab	12.3
C	24.8 ab	27.0 ab	22.8 b	24.8 ab	25.6 ab	26.5 ab	28.1 a	25.1 ab	25.6
				4th growth period (1/20 to 11/19 – 31 days)					
A	51.3 a	50.5 ab	51.4 a	44.3 bc	46.5 b	42.2 bc	39.1 c	40.6 c	45.7
B1	7.4 c	5.3 c	6.1 c	13.7 a	9.0 b	12.9 a	10.6 ab	9.2 b	9.3
B2	7.6 bc	6.1 c	7.3 bc	8.3 b	10.6 a	8.2 b	8.2 b	8.4 b	8.1
B3	8.8 d	13.2 c	17.9 b	4.5 e	8.8 d	16.1 bc	21.2 a	24.5 a	14.4
C	24.9 ab	24.9 ab	17.3 c	29.2 a	25.1 ab	20.6 b	20.9 b	17.3 c	22.5
				5th growth period (11/20 to 1/10 – 52 days)					
A	29.9 ab	27.5 b	30.7 ab	29.1 ab	32.9 a	32.8 a	25.6 b	23.4 c	28.9
B1	9.0 ab	8.3 b	9.9 ab	8.1 b	10.4 a	11.8 a	10.5 a	12.5 a	10.1
B2	29.3 a	28.6 ab	21.7 c	21.9 c	20.3 c	23.6 c	27.2 ab	26.5 b	24.9
B3	15.1 ab	12.8 b	13.2 b	17.2 a	11.9 b	7.0 c	11.4 b	18.3 a	13.4
C	16.7 c	22.8 ab	24.5 a	23.7 ab	24.5 a	24.8 a	25.3 a	19.3 bc	22.7

Means followed by different small letters in the rows differ among themselves (p > 0.10). AP: bristle oats; AA: yellow oats; T: triticale; T-85: Tifton-85. A = non-protein nitrogen; B1 = fast degradable soluble portion; B2 = non-soluble portion with intermediate rate of degradation; B3 = slow degradable non-soluble portion; C = non-soluble and non-degradable portion.

Fraction B1 is only slightly relevant in forager plants since it always represents less than 15% of total nitrogen (BALSALOBRE et al., 2003).

The higher the rates of fractions A and B1, the greater is the need for fast degrading carbohydrate supplementation and the adequate synchronism of carbohydrates and proteins fermentation in the rumen. The sum of these fractions in current study is higher than that reported in grass Tifton 85 (19.9%) investigated by Malafaia et al. (1997).

The proportion of non-soluble protein, with an intermediate degradation rate (fraction B2), ranged between 6.1% (fourth growth period) in yellow oats pasture and 29.3% (fifth growth period) in bristle oats pasture (Table 3). The proportion of non-soluble protein, with a slow degradation rate (fraction B3), ranged between 4.5% (fourth growth period) in pasture with bristle oats + yellow oats and 33.8% (first growth period) in pasture with bristle oats + triticale (Table 3).

Since fraction B3 has a slow degradation rate and depends on the rate of the passage from the solid phase to the rumen, low degradations probably occur. Consequently, fraction proportions, which represent approximately 70% of the nitrogen of pastures under analysis (A, B3 and C), may cause problems when used by ruminants. In spite of the high rates of crude protein in these pastures, rumen liabilities in protein may occur at some specific instance after the intake of forage by the animals.

Non-soluble and non-digestible protein proportion in the rumen and intestines (fraction C) ranged between 11.1% (first growth period) in pastures with bristle oats + triticale and 28.1% (third growth period) in pasture with bristle oats + yellow oats + triticale (Table 3). From the nutritional point of view, increase in CP non-availability is one of the most negative effects in the plant's increasing physiological age. However, Van Soest (1994) reported that between 5 and 15% of total nitrogen of forager plants are linked to lignin in a totally unavailable form. In current study, rates are higher.

Cabral et al. (2000b) registered higher proportions of fractions A and C and lower fractions B1, B2 and B3 in Tifton 85 harvested at 50 cm height. This fact has also been reported in current study.

Table 4 shows results of total carbohydrate contents (%) in exclusive Tifton 85 pasture oversown with winter forager plants. There was no significant difference ($p > 0.10$) in the interaction between pastures and growth periods. Significant difference ($p < 0.10$) occurred in mean rates between evaluated pastures and growth periods.

Total carbohydrate rates varied from 70.7 to 77.0% during the growth period. Variation was due to the botanic composition of each component at evaluation (MOREIRA et al., 2005). Total carbohydrates are divided into structural, non-structural and non-digestible fiber, which are fractioned according to degradation rates.

Resulting rates of total carbohydrates in exclusive pasture Tifton 85 (76.1%) are lower than those reported by Cabral et al. (2000a) with rate 78.1%.

Total carbohydrate rates in current study corroborated those by Van Soest (1994), and made up between 50 and 80% of dry matter of forager plants. Carbohydrates represent the main energy source for microbial fermentation which converts them into volatile fatty acids (VFA). Exclusive Tifton 85 had higher total carbohydrate rates ($p < 0.10$) than the other treatments under analysis. Nevertheless, carbohydrate profile in forage is highly relevant to know whether they may be potentially used by microbial flora, as Table 5 shows.

In the case of carbohydrate fractions, all evaluations (Table 5) showed a great variety which was influenced by total carbohydrate rate of each forager plant, by the botanic composition at evaluation and by the leaf–stem relationship of the pastures under analysis (MOREIRA et al., 2005).

Rapid degradation proportion in the rumen, represented by fractions A+B1, which corresponds to soluble carbohydrates and to starch in pastures Tifton 85 with oversowing, had a higher rate during the first growth period due to a greater proportion of winter forager plants at evaluation (MOREIRA et al., 2005).

Table 4. Total carbohydrate rates (%) of exclusive Tifton 85 oversown with winter forager plants.

Treatment	Year period and growth period					Mean
	5/30 to 7/27 59 days	7/28 to 9/10 45 days	9/11 to 10/19 39 days	10/20 to 11/19 31 days	11/20 to 1/10 52 days	
AP	71.6	73.6	74.2	78.1	71.4	73.8 BC
AA	74.4	74.9	75.2	77.6	70.4	74.5 B
T	70.9	76.6	76.2	77.5	69.6	74.2 BC
AP + AA	72.0	72.0	74.9	77.8	69.2	73.2 C
AP + T	69.6	74.4	74.5	77.8	71.2	73.5 BC
AA + T	72.0	74.7	74.8	78.3	70.5	74.1 BC
AP+AA+T	72.0	72.7	75.9	76.1	70.2	73.4 BC
T-85	75.3	75.6	77.3	79.3	73.2	76.1 A
Mean	72.2 d	74.3 c	75.4 b	77.0 a	70.7 e	

Means followed by different small letters in the rows and big letters in the columns differ among themselves ($p > 0.10$). AP: bristle oats; AA: yellow oats; T: triticale; T-85: Tifton-85.

Table 5. Composition of carbohydrates as percentages of total carbohydrates in dry matter (% CT) of exclusive pasture Tifton 85 oversown with winter forager plants.

Fraction	Treatments								Mean
	AP	AA	T	AP+AA	AP+T	AA+T	AP+AA+T	T-85	
	First growth period (5/30 to 7/27 – 59 days)								
A+B1	23.2 b	28.5 ab	19.3 c	31.4 a	29.6 ab	31.2 a	28.7 ab	10.5 d	25.3
B2	59.4 ab	54.1 b	62.4 a	50.4 b	49.8 c	51.3 b	50.5 b	68.1 a	55.8
C	17.4 a	17.4 a	18.3 a	18.2 a	20.6 a	17.5 a	20.8 a	21.4 a	18.9
	Second growth period (7/28 to 9/10 – 45 days)								
A+B1	19.8 ab	17.7 b	20.4 a	19.7 ab	23.4 a	21.6 a	18.3 b	9.1 c	18.7
B2	64.3 ab	65.9 ab	63.4 ab	62.9 b	59.4 b	59.9 b	67.8 a	73.1 a	64.6
C	15.9 a	16.4 a	16.2 a	17.4 a	17.2 a	18.5 a	13.9 b	17.8 a	16.7
	Third growth period (9/11 to 10/19 – 39 days)								
A+B1	15.5 a	14.9 a	14.1 a	14.3 a	15.8 a	16.1 a	13.8 a	10.2 b	14.3
B2	71.3 a	69.2 a	70.7 a	67.7 b	68.6 ab	68.2 ab	69.5 a	72.7 a	69.8
C	13.2 c	15.9 b	15.2 b	18.0 a	15.6 b	15.7 b	16.7 ab	17.1 a	15.9
	Fourth growth period (10/20 to 11/19 – 31 days)								
A+B1	15.8 a	14.6 b	14.2 b	13.9 ab	13.9 ab	14.6 b	12.1 b	17.1 a	14.5
B2	69.0 a	67.2 a	67.5 a	67.3 a	67.7 a	65.9 b	69.1 a	62.8 b	67.1
C	15.2 b	18.2 a	18.3 a	18.8 a	18.4 a	19.5 a	18.8 a	20.1 a	18.4
	Fifth growth period (11/20 to 1/10 – 52 days)								
A+B1	18.6 ab	17.9 b	19.8 a	20.1 a	17.7 b	19.5 a	8.4 ab	16.6 b	18.6
B2	69.8 b	73.4 a	70.4 ab	70.2 ab	70.0 ab	67.6 b	73.2 a	70.7 ab	70.7
C	11.6 a	8.7 a	9.6 ab	9.7 ab	12.3 a	12.9 a	8.4 b	12.7 a	10.7

Means followed by different small letters in the rows differ among themselves ($p > 0.10$). AP: bristle oats; AA: yellow oats; T: triticale; T-85: Tifton-85; A = non-protein nitrogen; B1 = fast degradable soluble portion; B2 = non-soluble portion with intermediate degradation rate; B3 = slow degradable non-soluble portion; C = non-soluble and non-degradable portion.

Rates in other evaluations are similar due to the fact that all treatments show higher rates of Tifton 85 in their botanic composition (MOREIRA et al., 2005).

Fractions A+B1 (% CT) rates of pastures under analysis, ranging between 8.4 and 31.4%, were higher than those for grass calculated by Malafaia et al. (1998), which varied from 0.74 to 11.62% of carbohydrate proportion, and by Vieira et al. (2000) in native pastures which revealed A+B1 rates between 11.0 and 15.1% of total carbohydrates, respectively, during the dry and rainy seasons.

On the other hand, Valadares Filho et al. (2006) emphasized that the inclusion of fast and intermediate degradation protein sources in the rumen is required for synchronization between energy release and nitrogen when fraction A+B1 composes the main fraction of the diet's carbohydrates.

Sugar synthesis occurs during the grass's productive life. Excess, which is not used in maintenance and growth, is deposited as starch or fructosans. They may undergo the reverse process, till they become sugar, in situations where plants may require more energy than the amount synthesized. Since developing plants require the maintenance of growth organs, portions of their cell walls increases at the cost of non-structural carbohydrates (VAN SOEST, 1994), although it is an irreversible pathway.

In the case of the proportion of carbohydrates digestible by the cell wall (fraction B2), rates of pasture Tifton 85 were higher during the first three evaluation periods when compared to oversown Tifton 85. On the other hand, the fourth evaluation showed the lowest rate in pasture grass Tifton 85 whereas the same rates were reported during the fifth growth period. B2 in all evaluations performs all the carbohydrates with its availability in the rumen, associated with digestion rate.

Bulky feeds, characterized by high rates in neutral detergent fiber, as verified in Tifton 85, have a higher B2 fraction of carbohydrates which may affect the efficiency of microbial synthesis and animal performance due to the slow provision of energy to the rumen. Intake may be limited through the high indigestible fraction (fraction C) as reported by Malafaia et al. (1998) and Cabral et al. (2000a).

Although fraction B2 is potentially digestible, Russell et al. (1992) insist that roughage rich in the fraction B2 require non-protein nitrogen to attend to nitrogen requirements of rumen microorganisms which ferment structural carbohydrates.

The digestible part of the cell wall (fraction C) in each growth period (Table 5) varied from 17.4 to 21.4; 13.9 to 18.5; 13.2 to 18.0; 15.2 to 20.1 and 8.4 to 12.9% in the proportion of total carbohydrates respectively from the first to the fifth growth period. Cabral et al. (2000a) reported than Tifton 85 with a height of 50 cm has a higher proportion of non-digestible cell wall (fraction C) than that with a height of 30 cm (19.3 x 16.6%). Malafaia et al. (1998) registered rates between 15.8 and 25.2% in fraction C in grasses and insisted that this fraction is related to the digestibility of the carbohydrates. Fraction C mean rates in current study (between 10.7 and 18.9%) were lower than those reported by the author, which may be due to the low lignin rates of the forager plants under analysis.

It should be emphasized that the negative effect of lignin significantly decreases energy availability of tropical plants for ruminants. However, rates of fraction A+B1 of carbohydrates (Table 5) and adequate rates with regard to the proportion of fraction A (Table 3) of nitrogenated compounds should be taken into account. Probably, this will benefit much of the nitrogenated fraction owing to the synchronization of the degradation of these fractions in the animals' rumen.

Conclusion

Exclusive grass pastures Tifton 85 or oversown with winter grasses have adequate rates of fraction A+B1 of carbohydrates and of fraction A of nitrogenated compounds so that they could benefit ruminants. High solubility of carbohydrates and of proteins in all treatments under analysis demonstrate the quality of the forager plants and the possibility of their use as relevant forager supplementation in system based on grass pasture Tifton 85.

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