



Fiber composition and digestibility of fodder in different ryegrass fields submitted to different harvesting management systems

[Composição da fibra e digestibilidade da forragem de diferentes cultivares de azevém submetidos a diferentes sistemas de manejo de colheita]

M. Neumann¹, A. Dochwat², L.C. Santos², A.M. Souza^{2*}, R.K. Ueno³,
R. Carletto³, A.D. Manchur⁴, C. Czelusniak⁴

¹Universidade Estadual do Centro-Oeste - Guarapuava, PR

²Programa de pós-graduação - Universidade Estadual do Centro-Oeste - Guarapuava, PR

³Cooperativa Agroindustrial Aliança de Carnes Nobres Vale do Jordão - Guarapuava, PR

⁴Programa de graduação - Universidade Estadual do Centro-Oeste - Guarapuava, PR

ABSTRACT

This essay aims to evaluate the composition of fiber in neutral detergent, digestibility of plant components, as well as ruminal disappearance rate of fodder dry matter from five ryegrass fields submitted to different cut systems for the production of haylage. The experimental design was the randomized blocks one, at a 5 x 3 factorial scheme, with five cultivars (cv.) of ryegrass *Lolium multiflorum* (cv. Barjumbo, cv. BarHQ, cv. Ribeye, cv. Potro and cv. Willians) associated with three harvesting management systems: 1– single harvesting system at a pre-floral stage; 2 – double harvesting system, with a cut at vegetative stage and another at pre-floral stage; and 3 – triple harvesting system, with a cut at vegetative stage, a cut at full vegetative stage and a cut at pre-floral stage, with three repetitions each. Similarities were noticed on the results of fodder digestibility of different fields, however, cv. Potro presented a higher ruminal disappearance rate after 48 hours, with 69.27%. Generally, the harvesting management system with the increase of ryegrass cut frequency determined increments on the percentage of lignin and the reduction in the concentration of total nutrients and dry matter digestibility of the resulting haylage.

Keywords: ruminal disappearance, winter fodder, lignin

RESUMO

O objetivo do presente trabalho foi avaliar a composição da fibra em detergente neutro, digestibilidade dos componentes da planta, bem como a taxa de desaparecimento ruminal da matéria seca da forragem de cinco cultivares de azevém submetidos a diferentes sistemas de cortes para produção de silagem pré-secada. O delineamento experimental foi em blocos ao acaso, em um fatorial 5 x 3, sendo cinco cultivares de azevém *Lolium multiflorum* (cv. Barjumbo, cv. BarHQ, cv. Ribeye, cv. Potro e cv. Willians) associados a três sistemas de manejo de colheita: 1 – sistema com única colheita no estágio de pré-florescimento; 2 – sistema com uma colheita no estágio vegetativo e outra no estágio de pré-florescimento; e 3 – sistema com uma colheita no estágio vegetativo, uma no estágio pleno vegetativo e outra no estágio de pré-florescimento, com três repetições cada. Notou-se similaridade entre os resultados de digestibilidade da forragem entre os cultivares, porém o cv. Potro apresentou a maior taxa de desaparecimento ruminal após 48 horas, com 69,27%. De maneira geral, o sistema de manejo de colheita mostrou que o aumento do número de cortes do azevém determinou incrementos nos teores de lignina e redução na concentração de nutrientes digestíveis totais e da digestibilidade da matéria seca nas silagens pré-secadas resultantes.

Palavras-chave: desaparecimento ruminal, forragem de inverno, lignina

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*Autor para correspondência (corresponding author)

E-mail: andrems_92@hotmail.com

INTRODUCTION

Ryegrass is a fodder winter plant, majorly cultivated in temperate and subtropical areas of the globe (Bressolin, 2007). The two main species are from the *Lolium*, *L. multiflorum* (italian ryegrass) and *L. perenne* (perennial ryegrass) gender. These species freely cross between them and, as a result of the evolution and natural adaptation to different environments and crossing by breeders, show a continuous variation gradient, that goes from fully annual to fully perennial (Forrajeras..., 2010).

The southern Brazilian region is privileged for having a climate able to attend the necessities of different winter cultures, which present a higher nutritional value when compared to tropical species. As an example, Pires *et al.* (2006) and Bumbieris Junior *et al.* (2011) evidence big degradability rates in some winter grains, both highlighting great levels of soluble carbohydrates on the materials. Studies on ruminal kinetics of winter cereals are still scarce, though.

Countless models have been developed (Ellis *et al.*, 1994; France *et al.*, 1998; Mertens, 2005), and traditional mathematical functions have been readjusted for the utilization on the interpretation of ruminal kinetics. For the application of new prediction systems of exigencies on the nutrition of ruminants, new trustworthy estimates of ruminal degradability are needed. The systems used determine degradability values for each kind of food (Bumbieris Junior *et al.*, 2011). However, more current and complex results are required, because there can be differences between cultivars of the same species of fodder, for instance.

In this context, more studies concerning ruminal degradation kinetics of different foods used in ruminant nutrition, especially the voluminous ones, are being held. This fact is useful for contributing with the balancing of diets and the needs of ruminant animals (Pires *et al.*, 2006). On the other hand, most researches that evaluate species, cultivars and harvest systems are only based on biomass production, not considering the nutritional quality of the ruminal environment.

In their vegetative stage, winter grains count with high gross protein amounts (Fontaneli *et al.*, 2009), reducing the necessity of supplementation with protein concentrates. Besides, this is the

phase when the fiber has the biggest ruminal degradation potential and there is a great variation of this potential among the many species of winter grains, as well as harvesting managements (Bumbieris Junior *et al.*, 2011). That being said, this research aims to evaluate the composition of fiber in neutral detergent, *in situ* digestibility of the structural components of the plant, as well as dry matter ruminal disappearance of fodder in five ryegrass fields, under different harvesting management systems for the production of haylage.

MATERIALS AND METHODS

The experiment was conducted by the Animal Production Center (NUPRAN) along with the Master's Degree Course in Agronomy in the Vegetable Production area, belonging to the Agrarian and Environmental Center of Center-West State University (UNICENTRO), located in Guarapuava, state of Paraná, placed on Paraná's subtropical zone, under the geographic coordinates 25°23'02" south latitude and 51°29'43" west longitude, 1,026 meters of altitude.

The climate in the region, according to the Köppen classification is Cfb (Humid Mesothermic Subtropical), with cool summer seasons and moderated winter seasons, without a defined dry season and with severe frosts. The annual precipitation is around 1,944mm, and the average minimum temperature is 12.7°C, while the maximum average temperature is 23/5°C with a relative humidity of 77/9%.

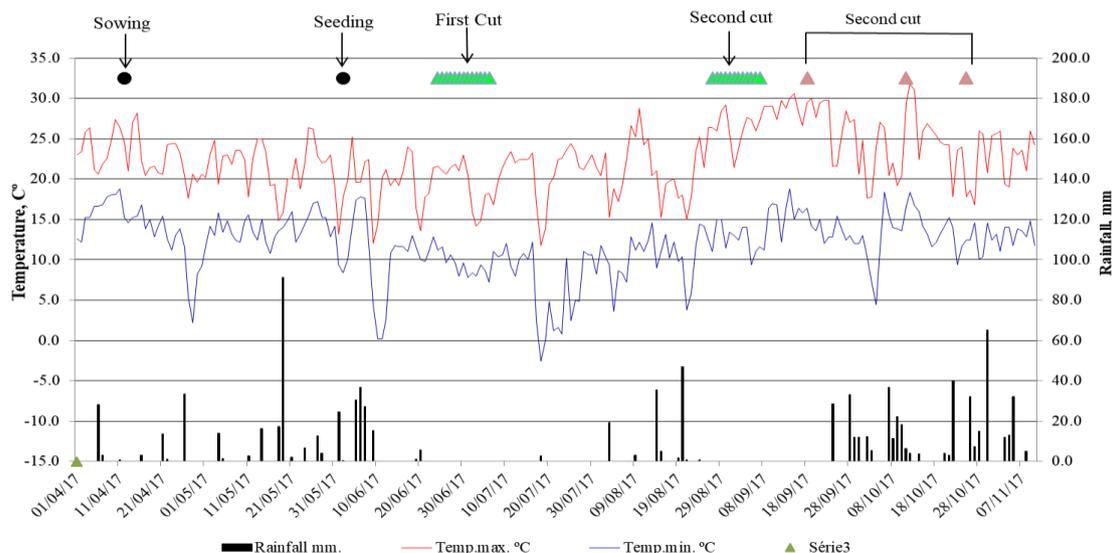
The soil of the experimental area was classified as Typical Dark-Red Oxisol (Pott, 2007), and presented the following chemical characteristics (0 to 20 centimeters profile): pH CaCl₂ 0/01M: 4/7; P: 1/1mg dm⁻³; K⁺: 0/2cmolc dm⁻³; MO: 2/62g dm⁻³; Al³⁺: 0/0cmolc dm⁻³; H⁺ +Al³⁺: 5/2cmolc dm⁻³; Ca²⁺: 5/0cmolc dm⁻³; Mg²⁺: 5/0cmolc dm⁻³ and base saturation (V%): 67/3%. The objective was to evaluate the composition of fiber in neutral detergent, *in situ* digestibility of the structural components of the plant, as well as dry matter ruminal disappearance of fodder in five ryegrass fields, under different harvesting management systems for the production of haylage.

Fiber composition...

The experimental design was the randomized blocks one, at a 5 x 3 factorial scheme, with five cultivars (cv.) of ryegrass *Lolium multiflorum* (cv. Barjumbo, cv. BarHQ, cv. Ribeye, cv. Potro and cv. Willians) associated with three harvesting management systems: 1– single harvesting system at a pre-floral stage; 2 – double harvesting system, with a cut at vegetative stage and another at pre-floral stage; and 3 – triple harvesting system, with a cut at vegetative stage, a cut at full vegetative stage and a cut at pre-floral stage, with three

repetitions each. On each repetition, a parcel of 10.5m² (3m x 3.5m) was presented. The cultivars Ribeye and Willians are diploid hybrids and the cultivars BarHQ, Barjumbo and Potro are tetraploids hybrids.

Figure 1 shows the average rain occurrence in millimeters and the maximum and minimum temperature in Celsius degrees during the experimentation period, as well as the days of seeding, nitrogen application and cuts.



Source: Experimental station of SIMEPAR/UNICENTRO, Guarapuava, PR, 2017.

Figure 1. Average rainfall in millimeters and maximum and minimum temperature in Celsius occurred in the cultivation period.

The ryegrass cultivars were sown according to the agricultural zoning for the Guarapuava, Paraná region, in no-till system. The sowing was performed with a space of 0.17 meters between lines, in a seeding depth of approximately two centimeters and a seeding density of 22kg ha⁻¹. Due to sowing, the fertilizing base was 280kg ha⁻¹ of the 04-20-20 (N-P₂O₅-K₂O) fertilizer, according to recommendations of the Fertility Commission of Soil in Santa Catarina and Rio Grande do Sul (Manual..., 2004). Nitrogen cover fertilization was made in a single application, 60 days after seeding, with 100kg ha⁻¹ of urea (46-00-00).

The weeds were chemically controlled by the use of *Glifosate* based herbicides (commercial product Roundup WG®: 3.0kg ha⁻¹) in the desiccation of the experimental area, 15 days before seeding, and in the culture management 30

days after planting, with the application of a metsulfuron-metyl based herbicide (commercial product Ally®: 6.6g ha⁻¹).

The plants were cut at 10 centimeters from the ground, by hand, and according to each treatment, as seen in Figure. 1. The cuts performed at the vegetative stage and full vegetative stage reached a light interception of 90 to 95%. The light interception (LI) was estimated by photosynthetically active radiation (PAR), measured by a digital linear heptometer model AccuPAR LP- 80 (Decagon, Devices).

Immediately after harvesting, a homogeneous sample of each unit was collected and sent to laboratory for determination of physical composition of the plant by the manual segmentation of the physical compounds stem, green leaves and senescent leaves, as well as dry

matter percentage, by drying forced air greenhouse regulated at 55°C until the obtainment of constant weight.

Pre-dried samples of the original material were milled in a "Willey" type mill, with a 1 millimeter sieve, hence determining the fiber content in neutral detergent (FDN), fiber in acid detergent (FDA) and lignin (LIG) according to Silva e Queiroz (2009). From the referred values, the hemicellulose percentage was estimated (HEM) by difference between FDN and FDA and cellulose (CEL) by difference between FDN and LIG. The content of total digestive nutrients (NDT, %) was obtained via the equation [NDT, % = 87.84 - (0.70 x FDA)], suggested by Bolsen *et al.* (1996).

The ruminal disappearance rate was determined by *in situ* technic, using nylon bags measuring 12cm x 8cm and with 40 to 60µm pores, contending 5 grams of dry samples of each material, milled to 1mm, for posterior rumen incubation (Nocek, 1988). Incubation period used for fodder were 0, 6, 12, 24, 36 and 48 hours, where 0-hour time represents the soluble fraction of dry matter. For such, a 48-month old calf was used, weighting 650 kilos, and bearing rumen fistulation.

The data were submitted to the F test, at 5% probability, through variation analysis (ANOVA) and then, when the difference was found, the Tukey test was performed in order to compare multiple pairs at 5% of significance, by means of the SAS (version 6.4) program. The data referring to the ruminal disappearance rate of dry matter were conducted by regression analysis (proc reg) in the statistics program SAS (version 6.4).

RESULTS AND DISCUSSIONS

Table 1 presents the data referring to the amount of hemicellulose e cellulose of the plants in different ryegrass fields under different harvesting management systems. There was no difference ($P>0.05$) among the cultivars at the pre-floral stage, showing an average level of 25.94% of hemicellulose. On the other hand, comparing the amount of cellulose, cvs. Barjumbo and Ribeye presented the highest levels ($P<0.05$) with 33.21% and 31.22%, comparatively to cvs. BarHQ and Potro with 27.46% and 28.82%, respectively.

It is also possible to observe in Table 1 that there were differences ($P<0.05$) among the harvesting management systems, given that the one-cut system showed a lower hemicellulose value at the pre-floral stage ($P<0.05$), with 21.45%. Meanwhile, the management systems which received a cut at vegetative stage presented higher values of 27.34% in the two-cut system and 29.04% in the three-cut system. Lignin levels presented in Table 2 also show differences ($P<0.05$) among the evaluated cultivars. Cvs. BarHQ and Willians presented higher lignin levels at the pre-floral stage (12.24% and 10.62%, respectively). Comparatively, cv. Barjumbo had the lowest result, 8.38%. According to Jung *et al.* (1983), lignin can inhibit microbial growth and digestive enzymes activity, forming, still in the rumen, complex such as carbohydrates, narrowing their digestion.

It is also observable that, comparing cultivars at pre-floral stage, cvs. Barjumbo and Willians showed the lowest concentration ($P<0.05$) of total digestible nutrients (58.72% and 58.83%, respectively). Cv. Potro had the highest values (60.73%), while the rest of the fields presented intermediate similar averages. In their studies Ball *et al.* (2007) found values of total digestible nutrients for ryegrass at vegetative stage that varied from 63% to 68% and of 59% to 62% at pre-floral stage, values that go against the results of the present study.

Generally, as the number of harvests grew, the concentration of total digestible nutrients at pre-floral stage gradually decreased (Table 2), differing ($P<0.05$) among the harvesting management systems, while the levels of lignin raised, going from 61.30% and 7.68% in the one-cut system, to 59.46% and 10.18% in the two-cut system and to 58.04% and 12.26% in the three-cut system. Based on these lignin levels, the percentage of fiber in neutral detergent and fiber in acid detergent (Table 3) increased in systems with two and three cuts, due to the amount of lignin, once cellulose e hemicellulose (Table 1) were constant. Velásquez *et al.* (2010), evaluating black oats under successive cuts, report that as the number of cuts was raised, the levels of lignin also escalated, leading to an *in vitro* digestibility reduction of dry matter.

Fiber composition...

Table 1. Percentage of hemicellulose and cellulose of different ryegrass fields under different harvesting management systems

Cultivar	Management system	Stage at the cut			Average
		Vegetative	Full vegetative	Pre-floral	
Hemicellulose, % in dry matter					
Willians	One cut	-	-	19.91	25.70 a
	Two cuts	19.81	-	27.94	
	Three cuts	21.57	26.86	29.26	
Ribeye	One cut	-	-	19.08	25.98 a
	Two cuts	18.25	-	29.02	
	Three cuts	18.78	28.12	29.86	
BarHQ	One cut	-	-	22.53	26.98 a
	Two cuts	17.49	-	30.51	
	Three cuts	23.18	26.27	27.91	
Barjumbo	One cut	-	-	23.93	26.35 a
	Two cuts	20.57	-	25.87	
	Three cuts	22.16	24.59	29.26	
Potro	One cut	-	-	21.79	24.69 a
	Two cuts	22.72	-	23.36	
	Three cuts	23.55	27.94	28.92	
One-cut system average			-	21.45 B	
Two-cut system average			-	27.34 A	
Three-cut system average			26.76	29.04 A	
Amount of cellulose, % in dry matter					
Willians	One cut	-	-	30.78	30.81 abc
	Two cuts	15.81	-	31.02	
	Three cuts	17.02	22.93	30.64	
Ribeye	One cut	-	-	31.22	31.22 a
	Two cuts	14.56	-	33.21	
	Three cuts	15.30	17.64	29.23	
BarHQ	One cut	-	-	25.95	27.46 c
	Two cuts	15.98	-	25.18	
	Three cuts	16.01	13.11	31.26	
Barjumbo	One cut	-	-	33.76	33.21 a
	Two cuts	16.73	-	32.78	
	Three cuts	10.93	24.70	33.09	
Potro	One cut	-	-	29.49	28.82 bc
	Two cuts	18.99	-	29.61	
	Three cuts	20.83	20.84	27.37	
One-cut system average			-	30.24 A	
Two-cut system average			-	30.36 A	
Three-cut system average			19.84	30.32 A	

Averages followed by different capital letters in the column of comparison between cultivars differ by the Tukey 5% test.

Averages followed by different lower case in the column, while comparing cut systems differ among themselves by the Tukey 5% test.

Table 2. Percentage of lignin and total digestible nutrients of different ryegrass fields under different harvesting management systems

Cultivar	Management system	Stage at the cut			Average
		Vegetative	Full vegetative	Pre-floral	
Lignin, % in dry matter					
Willians	One cut	-	-	8.00	10.62 ab
	Two cuts	9.40	-	11.66	
	Three cuts	6.46	9.46	12.19	
Ribeye	One cut	-	-	6.24	9.06 bc
	Two cuts	11.98	-	6.61	
	Three cuts	12.13	13.47	14.32	
BarHQ	One cut	-	-	11.12	12.24 a
	Two cuts	5.32	-	13.65	
	Three cuts	7.06	15.56	11.96	
Barjumbo	One cut	-	-	5.44	8.38 c
	Two cuts	9.77	-	8.63	
	Three cuts	13.02	5.15	11.07	
Potro	One cut	-	-	7.58	9.90 bc
	Two cuts	5.32	-	10.37	
	Three cuts	5.45	10.91	11.76	
One cut system average			-	7.68 C	
Two cuts system average			-	10.18 B	
Three cuts system average			10.91	12.26 A	
Total digestible nutrients, %					
Willians	One cut	-	-	60.69	58.83 b
	Two cuts	70.19	-	57.96	
	Three cuts	71.40	65.17	57.86	
Ribeye	One cut	-	-	61.62	59.65 ab
	Two cuts	69.26	-	59.97	
	Three cuts	68.64	66.06	57.36	
BarHQ	One cut	-	-	61.89	60.04 ab
	Two cuts	72.93	-	60.65	
	Three cuts	71.69	67.77	57.59	
Barjumbo	One cut	-	-	60.40	58.72 b
	Two cuts	69.29	-	58.85	
	Three cuts	71.08	66.94	56.93	
Potro	One cut	-	-	61.89	60.73 a
	Two cuts	70.82	-	59.85	
	Three cuts	69.44	65.62	60.45	
One cut system average			-	61.30 A	
Two cuts system average			-	59.46 B	
Three cuts system average			66.31	58.04 C	

Averages followed by different capital letters in the column of comparison between cultivars differ by the Tukey 5% test.

Averages followed by different lower case in the column, while comparing cut systems differ among themselves by the Tukey 5% test.

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Table 3. *In situ* digestibility of dry matter of stems and leaves, under a 48-hour incubation, of different ryegrass fields under different harvesting management systems

Cultivar	Management system	Stage at the cut			Average
		Vegetative	Full vegetative	Pre-floral	
<i>In situ</i> digestibility of stems, % of the dry matter					
Willians	One cut	-	-	49.8	46.9 a
	Two cuts	87.9	-	49.7	
	Three cuts	83.1	33.8	41.2	
Ribeye	One cut	-	-	56.9	50.3 a
	Two cuts	76.8	-	51.8	
	Three cuts	79.9	40.9	42.1	
BarHQ	One cut	-	-	57.1	47.3 a
	Two cuts	84.6	-	47.3	
	Three cuts	87.9	41.1	37.3	
Barjumbo	One cut	-	-	48.1	44.4 a
	Two cuts	80.1	-	47.5	
	Three cuts	79.9	32.1	37.5	
Potro	One cut	-	-	58.3	49.9 a
	Two cuts	77.3	-	49.0	
	Three cuts	75.7	42.3	42.3	
One cut system average			-	54.0 A	
Two cuts system average			-	49.0 A	
Three cuts system average			38.1	40.1 B	
<i>In situ</i> digestibility of green leaves (senescent leaves), % of the dry matter					
Willians	One cut	-	-	67.3 (44.3)	56.2 b (43.1 b)
	Two cuts	81.3	-	55.1 (46.7)	
	Three cuts	82.5	51.3 (38.8)	46.1 (38.1)	
Ribeye	One cut	-	-	77.3 (48.5)	58.0 ab (42.3 b)
	Two cuts	90.2	-	53.0 (42.4)	
	Three cuts	92.9	61.3 (36.4)	43.6 (36.0)	
BarHQ	One cut	-	-	84.0 (60.0)	63.9 a (50.3 a)
	Two cuts	90.8	-	58.0 (50.5)	
	Three cuts	92.5	68.0 (56.9)	49.7 (40.5)	
Barjumbo	One cut	-	-	81.2 (60.2)	63.4 a (55.6 a)
	Two cuts	86.3	-	59.5 (58.4)	
	Three cuts	88.8	65.2 (54.2)	49.5 (48.4)	
Potro	One cut	-	-	76.9 (58.4)	60.5 ab (53.5 a)
	Two cuts	82.2	-	57.2 (56.1)	
	Three cuts	82.9	60.9 (44.9)	47.2 (46.1)	
One cut system average			-	77.3 A (54.3 A)	
Two cuts system average			-	56.5 B (50.8 A)	
Three cuts system average			61.3 (46.2)	47.2 C (41.8 C)	

Averages followed by different capital letters in the column of comparison between cultivars differ by the Tukey 5% test.

Averages followed by different lower case in the column, while comparing cut systems differ among themselves by the Tukey 5% test.

Table 3 presents the data for *in situ* digestibility of dry matter of the structural components of the plant in different ryegrass fields under different harvesting management systems. No difference was found ($P>0.05$) for the digestibility of stems

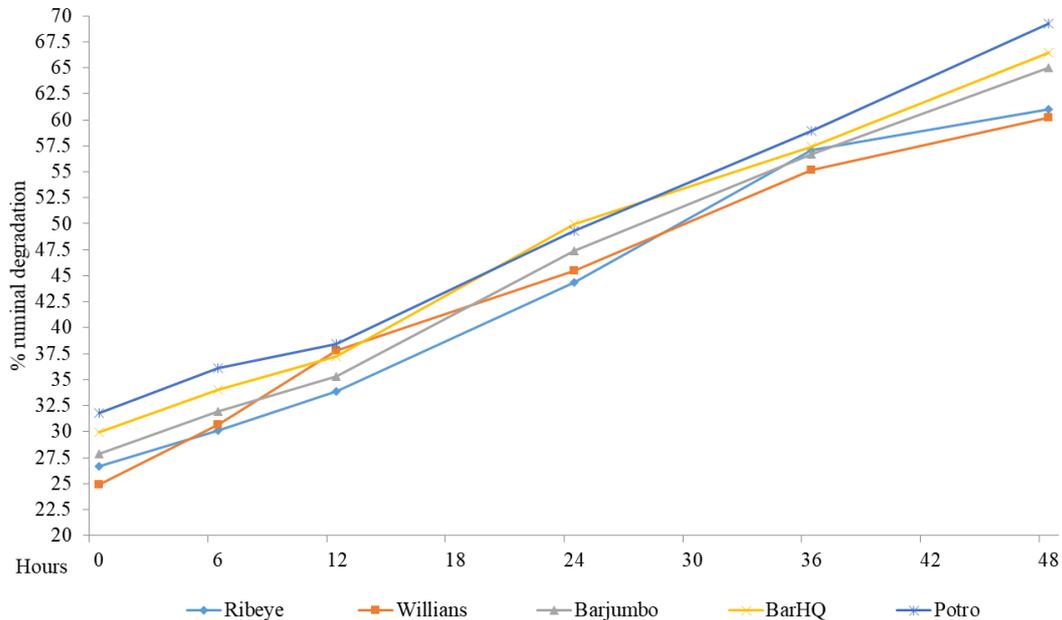
when comparing different cultivars. As for the green leaves, cvs. BarHQ and Barjumbo showed a higher digestibility (63.4% and 63.9% respectively), differing ($P<0,05$) from cv. Willians, which presented the lowest digestibility,

with 562%. Cvs. Ribeye and Potro showed a rate of 580% and 605%, respectively. For senescent leaves, cvs. Barjumbo, Potro and BarHQ presented higher ($P<0.05$) digestibility (556%, 53% and 503%, respectively), while cvs. Willians and Ribeye showed lower rates (431% and 423%).

Table 3 also shows that the harvesting management system directly influenced the final digestibility of the plant, since the digestibility of stems in the one and two-cut systems presented higher values, with 54.0% and 49.0%, both differing ($P<0.05$) from the three-cut system, with 40.1%. Green leaves digestibility decreased ($P<0.05$) as the number of harvests was raised,

going from 77.3% in the one-cut system, to 56.5% in the two-cut system and 47.2% in the three-cut system.

Concerning ruminal disappearance rate of dry matter of the plant in different ryegrass cultivars at the pre-floral stage (Figure. 2), it is possible to observe that cvs. Potro and BarHQ showed the highest concentration of soluble nutrients, number represented by the curve intercept, with 30.43% and 29.17%, respectively. Cvs. Ribeye and Willians had the lowest intercepts (25.61% and 25.62%), what might be related to a bigger proportion of stems in the physical structure of the plants on those fields.



●DMS Ribeye: $25.6195 + 0.7821H$ (CV: 22.71%; R^2 : 0.6585; $P=0.0001$), where H represents the incubation time, varying from 0 to 48 hours.

■DMS Willians: $25.6250 + 0.7688H$ (CV: 22.53%; R^2 : 0.6571; $P=0.0001$).

▲DMS Barjumbo: $26.9175 + 0.8084H$ (CV: 21.12%; R^2 : 0.6858; $P=0.0001$).

x DMS BarHQ: $29.1704 + 0.7874H$ (CV: 19.43%; R^2 : 0.6931; $P=0.0001$).

* DMS Potro: $30.4390 + 0.7976H$ (CV: 15.45%; R^2 : 0.7746; $P=0.0001$).

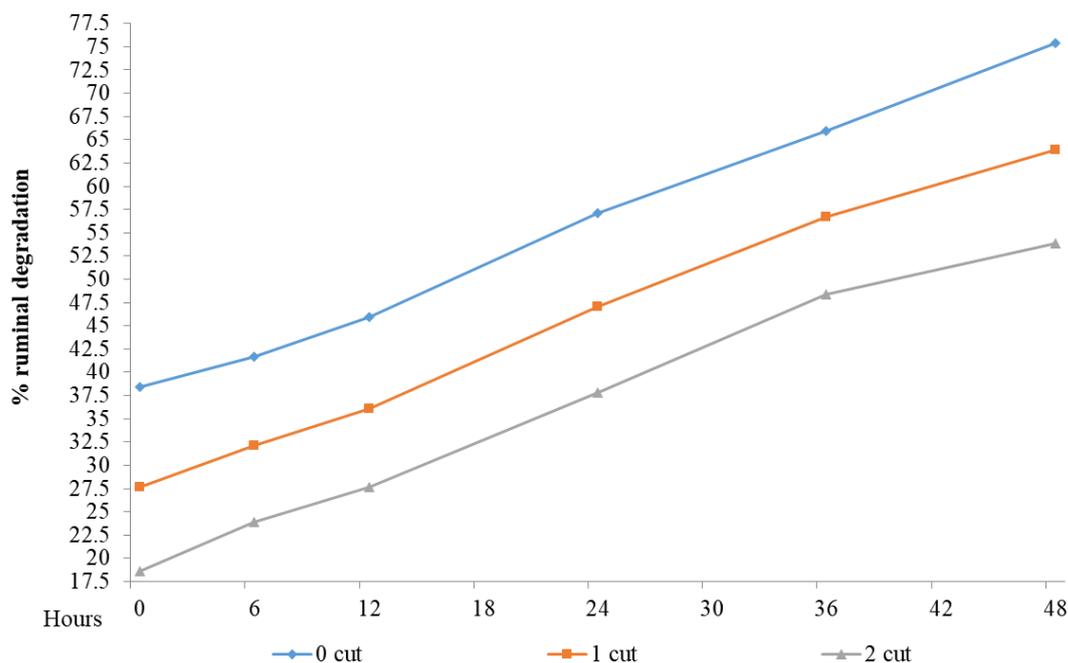
* “% de degradação ruminal” stands for ruminal degradation percentage; “Horas” stands for Hours.

Figure 2. Ruminal disappearance rate of dry matter of different ryegrass fields at pre-floral stage.

Regarding harvesting management systems (Figure. 3), as the number of cuts was raised, the ruminal disappearance rate of dry matter of the plant after 48 hours diminished among harvesting management systems, going from 75.39% in the one-cut system, to 63.88% in the two-cut system and 53.89% in the three-cut system, respectively.

The value presented by the curve intercept stands for the concentration of soluble nutrients, so that as the number cuts was raised the amount of nutrients decreased, going from 37.09% in the one-cut system, to 27.25% in the two-cut system and 18.81% in the three-cut system, respectively.

Fiber composition...



◆ DMS No cut: $37.0935 + 0.8015H$ (CV: 8.26%; R^2 : 0.9018; $P=0.001$), where H represents incubation hour, varying from 0 to 48 hours.

■ DMS One cut: $27.2503 + 0.7870H$ (CV: 9.93%; R^2 : 0.9020; $P=0.0001$).

▲ DMS Two cuts: $18.8179 + 0.7666H$ (CV: 14.75%; R^2 : 0.8623; $P=0.0001$).

* “% de degradação ruminal” stands for ruminal degradation percentage; “Horas” stands for Hours.

Figure 3. Percentage of disappearance of ryegrass dry matter submitted to different harvesting management systems at the pre-floral stage.

In general lines, ruminal disappearance rate of dry matter on plants obtained for the present essay can be rated as being of good quality, according to the Leng (1990) scale, which reports that fodder classified as low quality present values below 55%. Some authors established relationships among anatomy, chemical composition and digestibility of fodder grass (Wilson *et al.*, 1989). Correlations between the proportion of individual tissues, or in combination, and the nutritional entities were observed (Wilson *et al.*, 1989; Queiroz *et al.*, 2000). Generally, fibrous constituents of the fiber in neutral detergents (hemicellulose, cellulose and lignin) are negatively related to digestibility (Weiss, 1994; Queiroz *et al.*, 2000; Alves de Brito *et al.*, 2003).

CONCLUSION

Cvs. Ribeye and Barjumbo presented the highest levels of cellulose and cv. BarHQ showed the highest concentration of lignin. Regarding digestibility, cvs. Barjumbo and BarHQ reached better levels of green leaves digestibility and cv. Potro stood out for the great level of ruminal disappearance of fodder after 48 hours of incubation. In this harvesting management system, the raise of ryegrass cuts at the vegetative state determined growth in the lignin levels and reduction of total digestible nutrients and ruminal disappearance rates of dry matter in the resulting haylage.

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