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Protein fraction, degradability and digestibility of pearl millet silage at different cutting ages

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ABSTRACT. The determination of protein fraction and rumen fermentation characteristics of pearl millet genotypes is important, since generate information about food nutritional value and also guide the breeding programs of genotypes to be used in diets of ruminants. The objective of this research was to determine the digestion rates of protein fractions, dry matter degradability and in vitro dry matter digestibility of silages from pearl millet genotypes produced at different cutting ages. The experiment was carried out on the Agronomy campus of the Rio Verde University and on the Rio Verde campus of Goiano Federal Institute. The experimental design was randomized blocks with four replications in a 5 x 3 factorial arrangement, with five genotypes of millet: ARD 500, ADR 7010, LAB 0730, LAB 0731 and LAB 0732 and three cutting ages: 57, 65 and 73 days after sowing (DAS). The silage produced from pearl millet, regardless of genotype can be considered of good quality. The evaluated genotypes are considered early, so that the age that provided the best silage quality was 57 DAS. This age provided higher fractions A, lower fraction C and high degradability and digestibility.

Keywords: ensilage, genotypes, nutritional value, *Pennisetum glaucum* (L.) R. BR., rumen fermentation.

Fracionamento de proteína, degradabilidade e digestibilidade da silagem de milheto em diferentes idades de corte

RESUMO. As determinações das frações proteicas e características de fermentação ruminal de genótipos de milheto são de fundamental importância, pois geram informações relativas ao valor nutritivo do alimento e direcionam os programas de melhoramento genético a serem utilizadas na dieta de ruminantes. Diante disso, objetivou-se determinar as taxas de digestão das frações de proteína, degradabilidade ruminal da matéria seca e digestibilidade "in vitro" da matéria seca das silagens dos genótipos de milheto produzidas em diferentes épocas de corte. O experimento foi conduzido no Campus da Faculdade de Agronomia da Universidade de Rio Verde e Instituto Federal Goiano, Campus Rio Verde. O delineamento experimental utilizado foi de blocos ao acaso, com quatro repetições, em esquema fatorial 5 x 3, sendo, cinco cultivares de milheto: ARD 500, ADR 7010, LAB 0730, LAB 0731 e LAB 0732 e três idades de cortes: 57, 65 e 73 dias após a semeadura (DAS). Os resultados mostraram que as silagens produzidas por milheto, independente do genótipo, podem ser consideradas de boa qualidade. Por se tratar de materiais precoces a melhor idade que proporcionou melhor qualidade da silagem desses materiais, foi quando os materiais foram colhidos aos 57 DAS, em que proporcionaram maiores frações A, menores frações C e elevadas degradabilidade e digestibilidade.

Palavras-chave: ensilagem, genótipos, valor nutritivo, *Pennisetum glaucum* (L.) R. BR., fermentação ruminal.

Introduction

The number of pearl millet genotypes launched in the market has increased recently, which makes necessary a better nutritional evaluation of these materials in the silage form. Some studies describe the nutritional value of pearl millet silage (AMARAL et al., 2008; GUIMARÃES JR. et al., 2008). Also Guimarães, Jr. et al. (2008) reported that although the energy content of millet grain to be lower than corn and sorghum grain, it has a high protein content. This justifies the millet to be indicated as an interesting option for the ensiling process. However there are few studies related to the behavior of this feed during the rumen fermentation (PIRES et al., 2010).

The rumen fermentation characteristics of pearl millet genotypes are of fundamental importance, since generate information about the feed nutritional value and guide programs for breeding of

genotypes to be used in diets of ruminants. Through these studies, it is possible to evaluate the amount of nutrients available for microorganisms in the rumen and also the amount of nutrients that reach the intestine, which are important parameters in nutritional assessment of feed for ruminants (NRC, 2001).

The estimation of feed rumen degradation has been critical to evaluate the amount of nutrients available to rumen microorganisms and their quality (MOREIRA et al., 2003). The in situ degradability is based on the placement of small amounts of a feed in non-degradable porous bags and subsequent insertion (or incubation) in the rumen of cannulated steers (MOLINA et al., 2003a).

Besides degradability, currently, new systems and methodologies for ruminant feeds evaluating are being used in order to maximize the nutrients use by animals. The Cornell Net Carbohydrate and Protein System considers the dynamics of rumen fermentation and the potential loss of nitrogen as ammonia, in the feed evaluation (SNIFFEN et al., 1992). It also aims to adjust the carbohydrates and proteins digestion, trying to maximize microbial growth, reducing nitrogen losses by animals and to estimate the ruminal escape of nutrients (BALSALOBRE et al., 2003).

In this way, the protein fraction of new pearl millet genotypes will better characterize the crude protein of these materials. Therefore, the objective of this research was to determine the digestion rates of protein fractions, the in vitro dry matter digestibility and rumen digestibility of dry matter of silages of pearl millet genotypes produced at different cutting ages.

Material and methods

The experiment was carried out on the campus of the Agronomy Campus of the Rio Verde University and on the Rio Verde Campus of Instituto Federal Goiano. The experimental design was a randomized blocks with four replications in a 5 x 3 factorial arrangement, with five genotypes of pearl millet: ARD 500, ADR 7010, LAB 0730, LAB 0731 and LAB 0732 and three cutting ages: 57, 65 and 73 days after sowing (DAS), according to the following mathematical model:

$$Y_{ijk} = \mu + B_i + C_j + (BC)_{ij} + R_k + \varepsilon_{ijk},$$

where:

Y_{ijk} = observed value for the variable under study for the effect of the block in combination with pearl millet genotypes and cutting ages;

μ = Mean of the observations; B_i = effect of pearl millet genotype in the observed value Y_{ijk};

C_i = effect of cutting age in the observed value Y_{ijk};

$(BC)_{ij}$ = interaction effect of pearl millet genotype and cutting age;

R_k = block effect in the observation Y_{ijk};

εij= Random residual error of the observation Y_{ijk}.

For the fermentation process, the pearl millet genotypes were harvested on days 12, 19 and 26 of May, 2009, which are correlated with the cutting ages of 57, 65 and 73 DAS, respectively.

The methodology described by Sniffen et al. (1992) was used to determine the protein fractions, where the fraction A (non-protein nitrogen, NPN) was obtained from the treatment of a sample (0.5 g) with 50 mL of water for 30 minutes, after that it was added 10 mL of 10% trichloroacetic acid (TCA) for 30 minutes. The same was filtered and then the residue was oven dried (105ºC) for 8 hours.

A subsample (0.1 g) of the residue was removed for residual nitrogen determination. Fraction A was then calculated by the difference of total nitrogen minus the residual nitrogen. Next, a sub sample (0.1 g) was incubated with borate-phosphate ($NaH_2PO_4H_2O$ to 12.2 g L^{-1} + $Na_2B_4O_710H_2O$ to 8.91 g L^{-1} + 100 mL L^{-1} of tertiary butyl alcohol), determining the residual nitrogen in the insoluble borate buffer (TBF). The total soluble nitrogen (NPN + soluble protein) was obtained by difference between total nitrogen and residual nitrogen insoluble in TBF. The B1 fraction was obtained by difference between total soluble nitrogen fraction and the fraction A.

Fraction B2 was determined by the difference between the fraction insoluble in borate-phosphate buffer and the fraction of neutral detergent insoluble nitrogen (NDIN) (SNIFFEN et al., 1992). The B3 fraction resulted from the difference between the NDIN and acid detergent insoluble nitrogen (ADIN) (SNIFFEN et al., 1992). Fraction C was determined by acid detergent insoluble nitrogen (VAN SOEST et al., 1991). The protein insoluble in neutral detergent and acid detergent was obtained by multiplying NDIN and NIDA values by 6.25.

For the determination of rumen degradability, composite samples of silage per treatment were ground in Willey mill, with a 5mm mesh sieve. The degradability experiment was conducted at the Rio Verde Campus of Goiano Federal Institute. There were used three steers of 350 kg, cannulated in the rumen. The composite samples were incubated in the rumen in duplicate at the times of 96, 48, 24, 6

and 0h, using synthetic bags respecting the ratio of 20 mg of dry matter (DM) per square centimeter of surface. Bags after withdrawn from the rumen, together with zero time, were washed in running water for about 30 minutes and then dried in a forced air oven at 65°C for 48 hours, and weighed to determine the DM disappearance in the rumen. The percentage of dry matter disappearance per incubation time was calculated as the proportion of food that was left in the bags after incubation.

The in vitro dry matter digestibility (IVDMD) was estimated using the Daisy incubator (ANKON Technology Corporation, Fairport, USA). The results were subjected to analysis of variance and means were compared by Tukey's test at 5% of probability.

For degradability, the data of nutrients disappearance were fitted by nonlinear regression, which predicts the potential degradability (y = PD) of food through the model proposed by Mehez and Orskov (1977), as follows:

$y_{ijk} = a_{ik} + b_{ik}(1 - e^{-c_{ik}t_j})$, i-animal : 1, 2, ... , N; j-time : 1, 2, ... , J; and k-treatment : 1, 2, ... , K; (1)

where:

y is the percentage of nutrient degraded after time t (in hours);

a is the intercept of the curve or the soluble fraction of the material contained in the nylon bag;

b is the potentially degradable fraction of the material contained in nylon bag after time zero;

c is the fractional rate constant of degradation of the potentially degradable fraction;

t is the incubation time in the rumen, in hours.

In order to estimate the effective degradability (ED) it was used the model of Orskov and McDonald (1979):

$$ED = a + \frac{bc}{c + k^*} \quad (2),$$

in which k ⋆ is the rate of passage of rumen solids, whose value is set at 8% per hour.

The modeling follows the suggestion of a Bayesian approach (ROSSI et al., 2010), considering that the observations follow a normal distribution, i.e., where $y_i \sim N\left(f(t_i); \sigma^2\right)$, where *f(ti)* is the nonlinear function in (1). For the parameters *a* and *b*, were considered *a priori* non-informative normal distributions, i.e.: *a, b* ~ N(0.10^6) and for *c*, a non-informative Gamma distribution restricted in the interval (0.1), that is: $c \sim \text{Gama}(10^3,10^3)I_{(0.1)}$. For σ^2 it was assumed a Gamma distribution, i.e. $\sigma^2 \sim \text{Gama}(10^3,10^3)$. The results of the marginal distributions *a posteriori* for the parameters were obtained using the package *BRugs* of the R program (R DEVELOPMENT CORE TEAM, 2011).

For each parameter, 300,000 values were generated in a MCMC process (*Monte Carlo Markov Chain*), considering a period of sample discard of 10,000 initial values, so the final sample, obtained in jumps of every 30 values, contains 10,000 generated values. The convergence of the chains was verified by the *coda* package of the R program (R DEVELOPMENT CORE TEAM, 2011), and the criterion of Heidelberger and Welch (1983).

To compare treatments, multiple comparisons were performed between the distributions *a posteriori* of the mean values of the parameters of interest. It was considered as different at 5% of significance, treatments whose intervals of confidence for the mean differences do not include the value zero.

Results and discussion

As for protein fractions, Table 1 shows significant effects ($p < 0.05$) for pearl millet genotype, cutting age and interaction of these factors.

The Fraction A is considered the soluble fraction with rapid degradation in the rumen. It is possible to observe on Table 1 that the fraction A was similar for different genotypes at cutting ages of 57 and 65 DAS. At the age of 73 DAS the LAB 0730 genotype had a higher fraction A than ADR 500 and ADR 7010 genotypes, but it was similar to LAB 0731 and LAB 0732 genotypes.

Considering the cutting ages, only LAB 0730 genotype maintained the fraction A content. ADR 500, LAB 0731 and LAB 0732 reduced the fraction A content with increasing cutting age (73 DAS), while the genotype ADR 7010 reduced the fraction A at the age of 65 DAS. These results are due to the increase in NDF and ADF, with increased cutting age for the ensiling process, thereby reducing the protein solubility (COSTA et al., 2012).

Studies have found that with the silage fermentation, much of the protein is converted into non-protein nitrogen (NNP), due to proteolysis. Values of fraction A observed in this experiment for cutting ages of 57, 65 and 73 DAS were 41.40%, 40.01% and 26.22% respectively. The fraction A observed in this experiment was higher when compared to corn silage (5.93%) and sorghum (4.88%) in a study realized by Mello and Nörnberg (2004). The pearl millet silage produced in this experiment had crude protein values of 12.53, 11.45

and 9.00% for 57, 65 and 73 DAS (COSTA et al., 2012) which could explain the higher values of fraction A (Table 1) compared with other silages as corn and sorghum. In this way, according to these results pearl millet silage, independent of the cutting age, could be a good source of protein in the form of NNP for ruminant diets.

Table 1. Protein Fraction (%) of pearl millet genotypes ensiled at three cutting ages.

Pearl Millet Genotypes	Cuting ages (DAS)		
	57	65	73
	A Fraction		
ADR 500	43.75Aa	35.96Aa	22.14Bb
ADR 7010	42.46Aa	39.18Ab	23.33Bb
LAB 0730	40.07Aa	39.86Aa	34.02Aa
LAB 0731	38.31Aa	46.29Aa	23.65ABb
LAB 0732	42.45Aa	38.76Aa	28.20ABb
Mean	41.40	40.01	26.26
P value	.....	0.0230	.....
CV (%)	.....	12.15	.....
	B1 Fraction		
ADR 500	11.81Ab	4.38Bc	22.15Aa
ADR 7010	10.31ABb	12.57Ab	18.57Aba
LAB 0730	5.00Cb	10.91Aa	6.39Db
LAB 0731	6.59ABCb	5.56Bb	13.73BCa
LAB 0732	5.08BCb	12.98Aa	8.97CDab
Mean	7.75	9.28	13.96
P value	.....	0.0005	.....
CV (%)	.....	21.57	.....
	B2 Fraction		
ADR 500	6.28BCb	14.03Aa	18.73Aba
ADR 7010	3.27Cb	7.81BCb	16.41Ba
LAB 0730	10.18ABb	2.78Cc	23.02Aa
LAB 0731	12.92Ab	10.43ABb	22.27Aba
LAB 0732	5.42BCb	5.39BCb	19.74Aba
Mean	7.61	8.08	20.03
P value	.....	0.0046	.....
CV (%)	.....	21.77	.....
	B3 Fraction		
ADR 500	13.14ABa	13.50Aba	14.02Aa
ADR 7010	13.75Aa	10.54Cb	10.03Bb
LAB 0730	10.32Cb	14.58Aa	10.64Bb
LAB 0731	10.67BCa	11.04BCa	11.02Ba
LAB 0732	12.33ABCab	13.74Aa	11.11Bb
Mean	12.04	12.68	11.36
P value	.....	0.0030	.....
CV (%)	.....	33.66	.....
	C Fraction		
ADR 500	25.01Bb	32.10Aa	22.95Bb
ADR 7010	30.20ABa	29.89Aa	32.14Aa
LAB 0730	34.94Aa	31.86Aab	25.92ABb
LAB 0731	31.49ABa	27.00Aa	26.91Aba
LAB 0732	34.70Aa	29.11Aa	32.30Aa
Mean	31.26	29.99	28.04
P value	.....	0.0124	.....
CV (%)	.....	8.22	.....

Mean values followed by distinct letters, capital letter in columns (genotypes) and lower-case in the rows (cutting ages) are significantly different by Tukey's Test ($p < 0.05$). P-value refers to the interaction of cutting age x pearl millet genotype.

Fraction B1 is the soluble fraction rapidly degraded in the rumen (SNIFFEN et al., 1992). It is observed in Table 1 that at age of 57 DAS the B1 fraction was higher (11.81%) to ADR 500 genotype followed by ADR 7010 and LAB 0731. The lowest values were verified for LAB 0730 followed by LAB 0732. At the age of 65 DAS the highest values of fraction B1 were observed for ADR 7010, LAB 0732 and LAB 0730 genotypes while the lowest ones were obtained for ADR 500 and LAB 0731. At 73 DAS the highest value was achieved by ADR 500 genotype followed by ADR 7010 and the lowest value was registered for LAB 0730 genotype followed by LAB 0732.

Considering the cutting ages, ADR 7010 and LAB 0731 genotypes had an increase in fraction B1 at 73 DAS. Genotypes LAB 0730 and 0732 had this fraction increased at 65 DAS with further reduction at 73 DAS. The ADR 500 genotype showed a reduction in fraction B1 at 65 DAS and increased at 73 DAS.

Fraction B2 is the potentially degradable fraction, with a slower degradation rate. At the cutting age of 57 DAS the fraction B2 was higher for LAB 0731 (12.92%) genotype and lowest for ADR 7010 genotype. The other genotypes showed intermediate values. The ADR 500 genotype had higher content of the fraction B2 at 65 DAS compared with other genotypes, whereas the lowest value was verified for LAB 0730 genotype. At the age of 73 DAS the highest B2 fraction was obtained for silage of LAB 0730 and the lowest for ADR 7010.

As fraction B1 + B2 had higher ruminal degradation rate compared to fraction B3, they contribute to meet requirements of microorganisms for nitrogen (SNIFFEN et al., 1992). Considering the results in this experiment the pearl millet silage from evaluated genotypes had higher values of these fractions, which may be due to the high protein content (GUIMARÃES JR. et al., 2008).

Comparing the silage genotypes, in Table 1, the fraction B3 was higher for ADR 7010 genotype and lowest for LAB 0730 genotype at 57 DAS. At the cutting age of 65 DAS, the LAB 0730 along with LAB 0732 have the highest levels for fraction B3, whereas the lowest value was observed for ADR 7010. At the cutting age of 73 DAS, only ADR 500 genotype differed ($p < 0.05$) with the highest content of the fraction B3 (14.02%).

The genotypes ADR 500 and LAB 0731 maintained the contents of fraction B3 along the cutting ages. The ADR 7010 genotype showed lower amounts of fraction B3 at 65 DAS and continued this behavior at 75 DAS. The highest value of fraction B3 to LAB 0730 genotype was observed at 65 DAS. The LAB 0732 showed the highest value at 65 DAS followed by 57 and 73 DAS.

Mello and Nörnberg (2004) evaluated the protein fraction of corn, sorghum and sunflower silages, and found average values for the fraction B3 around 10.6, 9.2 and 17.5% respectively; these results were similar to those found in this study.

Fraction C is the indigestible fraction present in the gastrointestinal tract (acid detergent insoluble

protein). At the age of 57 DAS the lower value of fraction C was obtained for ADR 500 genotype. At 65 DAS there was no difference between genotypes ($p > 0.05$). At 73 DAS the highest value was observed for genotypes ADR 7010 and LAB 0732 and the lowest for ADR 500. The DAS effect was not significant ($p > 0.05$) for genotypes ADR 7010, LAB 0731 and LAB 0732. The greatest value of fraction C to 500 ADR was registered at 65 DAS. For the LAB 0730 there is a reduction of the fraction C at 73 DAS.

The fraction C of different pearl millet genotypes silages at different days after sowing (Table 1) was higher than observed for corn (14,1%), forage sorghum (18.3%) sorghum-sudangrass (20.6%) and sunflower (16.6%) silages observed by Viana et al. (2012). According to Sniffen et al. (1992), the increase in the fraction C occurs as a function of the Maillard products caused by undesirable fermentation in the silo, thus studies to reduce these products in the pearl millet ensilage should be carried out.

Table 2 shows the kinetic coefficients a, b, c and effective degradability (ED) calculated for rate passage of 8% per hour for dry matter of different pearl millet genotypes silages at different days after sowing (DAS).

For the water-soluble fraction, at 57 DAS the highest values were obtained for ADR 500 followed by ADR 7010, while the lowest value was obtained for LAB 0730, with values ranging from 24.47% to 32.07%. At 65 DAS, the highest amount of soluble fraction was obtained for ADR 7010 followed by ADR 500, and also the lowest value was verified for LAB 0730. At 73 DAS, the highest values were recorded by ADR 500 followed by ADR 7010 and the lowest values for LAB 0731 and LAB 0732.

In a study evaluating the dry matter degradability of corn and sorghum silages, Pires et al. (2010) found levels of a fraction at 38.5 and 12.5% for corn and sorghum silage, respectively. Cavalcante et al. (2012) found value of a fraction for pearl millet silage of 36.44% which is higher than the mean (29.32%) in Table 2 for the evaluated genotypes.

Considering the average soluble fraction (a) in the cutting ages (57, 65 and 73 DAS) there was a reduction of 12.75% from 57 DAS to 73 DAS. These results are due to the increase of fibrous fractions with the advancing maturity. The observed values were lower than obtained by Molina et al. (2003b) for corn (74.4%) and sorghum silage (75.4%).

The fraction b known as water-insoluble, but potentially degradable was higher for genotypes ADR 500, ADR 7010 and LAB 0730 at 57 DAS, and lower for genotypes LAB 0731 and LAB 0732. At 65 DAS, the highest value of fraction b was observed in genotypes ADR 500, followed by ADR 7010 and LAB 0730, again the lowest values were observed for LAB 0731 and LAB 0732. At 73 DAS, the highest value was verified for genotype LAB 0731, followed by LAB 0730, ADR 500 and ADR 7010, whereas the LAB 0732 remained with the lowest value. Considering the average fraction b from different genotypes at cutting ages evaluated (57, 65 and 73 DAS) the reduction was only of 1.36% showing a low variability. Mean values of fraction b in Table 2 are higher than reported by Cavalcante et al. (2012) for pearl millet silage (24.37%).

Table 2. Estimates of kinetic coefficients a, b, c and ED calculated for rate passage of 8% per hour for dry matter of different pearl millet genotypes silages at different days after sowing (DAS).

Pearl millet genotypes	a (%)	b (%)	c (h^{-1})	ED (%) k= 0.08
	57 DAS			
ADR 500	32.07a	52.58[a]	0.0104c	38.53[a]
ADR 7010	31.23b	52.73[a]	0.0105c	37.69ab
LAB 0730	24.47d	52.79[a]	0.0118b	31.63d
LAB 0731	28.16c	44.36b	0.0141a	35.11c
LAB 0732	30.66bc	44.29b	0.0122ab	37.12b
Mean	29.32	49.35	0.0118	36.01
	65 DAS			
ADR 500	27.53b	49.73a	0.0132b	35.01a
ADR 7010	28.98a	47.10b	0.0127c	35.81a
LAB 0730	26.57c	36.39c	0.0282a	36.26a
LAB 0731	25.62d	52.29d	0.0117d	32.79b
LAB 0732	25.07cd	52.82d	0.0098e	31.25b
Mean	26.75	47.60	0.01512	34.22
	73 DAS			
ADR 500	27.81a	44.74c	0.0142b	34.91a
ADR 7010	25.18b	38.34e	0.0193a	32.94c
LAB 0730	27.39c	53.28b	0.0115c	34.51b
LAB 0731	22.78d	64.66a	0.0107d	30.91d
LAB 0732	24.73bd	42.42d	0.0137b	31.24c
Mean	25.58	48.68	0.01388	32.90

Distinct letters indicate significant differences between treatments by Bayesian comparisons using 95% of credibility. a: water soluble fraction; b: water insoluble fraction but potentially degradable; c: degradation rate of b fraction; ED: effective degradability.

The fraction c (rate of degradation of fraction b), at 57 DAS was greater for genotypes LAB 0731, LAB 0732 followed by LAB 0730, ADR 500 and ADR 7010. At 65 DAS the highest value was obtained for LAB 0730 followed by ADR500, ADR 7010, LAB 0731 and LAB 0732. The fraction c was also different for the genotypes at 73 DAS and the highest value detected was for ADR 7010 and the lowest for LAB 0731. Genotypes ADR 500, LAB 0730 and LAB 0732 had intermediate values. The average fraction of the different cutting ages increased by 36.36% at 65 DAS and 18.18% at 73 DAS.

There was a significant effect ($p < 0.05$) of the interaction of pearl millet genotypes for the effective degradability (ED) calculated for passage rate of 8%. At 57 DAS the highest effective degradability was observed for ADR 500 followed by ADR 7010, the lowest value was obtained for LAB 0731. At 65 DAS, the highest values were obtained for ADR 500, ADR

7010 and LAB 0730 and the lowest for LAB 0731 and LAB 0732. At 73 DAS, the ADR 500 genotype remained with the highest value of degradability and the smallest value was for LAB 0731. Comparing the average effective degradability at 8% in different cutting ages there was a reduction of 8.64% from 57 to 73 DAS.

In an evaluation of rumen fermentation kinetics in pearl millet silage, Guimarães Jr. et al. (2008), obtained values of effective degradability (8%) of 14.92: 14.67 and 12.72% for silage of genotypes NPM-1; BRS-1501 and CMS-3, respectively. The values observed by these authors were lower than verified in this study. This difference between genotypes could be due to genetic improvement of the varieties, obtaining with this, new hybrids, which have certain superiority over nutritional value. This is known as genetic gain due to the selection of superior individuals in the improvement process of genotypes.

According to Table 3 there was an effect of cutting age for all genotypes on in vitro dry matter digestibility (IVDMD) ($p < 0.05$). There was no effect of genotypes at 57 DAS.

At 65 DAS the highest IVDMD were observed for ADR 7010, LAB 0730 and LAB 0731. At 73 DAS, the highest values were observed for ADR 500 and LAB 0730.

By evaluating the effect of age on each genotype, there was no effect for LAB 0730. For LAB 0731 there was a decrease at 73DAS. To the genotype LAB 0732 there was a decrease in the IVDMD from 65 DAS until 73 DAS. To the ADR 7010 genotype there was a decrease in the IVDMD at 65 and 73 DAS, in turn genotype ADR 500 reduced at 65 DAS, but increased at 73 DAS. The evaluated genotypes had low values of lignin (COSTA et al., 2012) that increased with the cutting age with probable influence on the IVDMD variability.

Table 3. In vitro dry matter digestibility (%) of pearl millet genotypes ensiled at three cutting ages.

Pearl Millets	Cutting ages (DAS)		
Genotypes	57	65	73
ADR 500	70.08Aa	62.60BCb	67.55Aa
ADR 7010	72.21Aa	68.41Ab	62.50Bc
LAB 0730	69.79Aa	67.81Aa	66.99Aa
LAB 0731	68.50Aa	66.77ABa	62.04Bb
LAB 0732	70.00Aa	60.80Cb	61.12Bb
Mean	70.11	65.27	64.04
P value	.....	0.0344	
CV (%)	.....	2.64	

Mean values followed by distinct letters, capital letter in columns (genotypes) and lower-case in the rows (cuts age), are significantly different by Tukey's Test ($P<0.05$). P-value refers to the interaction of cutting age x pearl millet genotype.

Guimarães JR. et al. (2005) examined the IVDMD of three pearl millet genotypes in different periods of fermentation and reported a mean value of 54.81%, which is lower than found in the present study.

Conclusion

The results indicated that the silage produced from pearl millet, regardless of genotype can be considered of good quality. The evaluated genotypes are considered early, so that the age that promoted the best silage quality was 57 DAS. This age provided higher fractions A, lower fraction C and high degradability and digestibility.

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