

Chemical characteristics of grass silage with the use of acidifier after opening the bag

Características químicas da silagem de capim com uso de acidificante após abertura do silo

Características químicas del ensilaje de pasto utilizando acidulante después de abrir el silo

DOI: 10.34188/bjaerv7n3-075

Submetido: 01/05/2024

Aprovado: 30/06/2024

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ABSTRACT

The objective of this work was to evaluate the chemical characteristics of Miyagi grass silage (*Megathyrsus maximus* cv. Miyagi), with the addition of moisture sequestrants (ground corn grain - GCG, and dried distillers grain with solubles and high fiber, DDGS), and addition of inoculant (SiloSolveMC) and/or acid (Mold-Nil Liquid). The experimental design was completely randomized in a 3x3 factorial arrangement, with five replications: factor 01, the use of moisture scavengers (without additive, with the addition of GCG and/or DDGS), and factor 2, the use of bacterial inoculant (SiloSolveMC) and/or acid (Mold-Nil Liquid). For the chemical evaluation of the silage, the percentage of dry matter (DM), the insoluble fiber in neutral detergent (NDF), mineral matter contents (MM), and crude protein (CP). There were no interactions between moisture scavengers, bacterial inoculants, and/or acids. The use of moisture scavengers interfered with DM ($P<0.05$), observing a value with GCG and DDGS use of 36.18% and 35.46%, respectively, higher than MGS (27,68%). For NDF values using GCG and DDGS, values of 51.39% and 65.47%, respectively, lower ($P<0.05$) than MGS (70.72%) were observed. The use of microbial inoculant and acid did not alter ($P>0.05$) the OM values, with an average value of 92%. As for CP, there was no interaction ($P>0.05$) of moisture scavengers, microbial inoculant, and/or acid. It is recommended to include moisture-sequestering foods associated with MGS to obtain better DM, NDF, and CP values after opening the bag and the use of microbial inoculants and/or acids in the MGS did not influence these characteristics.

Keywords: dry matter, crude protein, *Megathyrsus*, neutral detergent fiber.

RESUMO

O objetivo deste trabalho foi avaliar as características químicas da silagem de capim Miyagi (*Megathyrsus maximus* cv. Miyagi), com adição de sequestrantes de umidade (grão de milho moído - GCG e grão de destilaria seco com solúveis e alto teor de fibra, DDGS), e adição de inoculante (SiloSolveMC) e/ou ácido (Mold-Nil Liquid). O delineamento experimental foi inteiramente casualizado em esquema fatorial 3x3, com cinco repetições: fator 01, utilização de sequestrantes de umidade (sem aditivo, com adição de GCG e/ou DDGS) e fator 2, utilização de inoculante bacteriano (SiloSolveMC) e/ou ácido (Mold-Nil Liquid). Para avaliação química da silagem, foram determinados os teores de matéria seca (MS), fibra insolúvel em detergente neutro (FDN), matéria mineral (MM) e proteína bruta (PB). Não houve interações entre sequestrantes de umidade, inoculantes bacterianos e/ou ácidos. A utilização de sequestrantes de umidade interferiu na MS ($P<0,05$), observando-se valor com utilização de GCG e DDGS de 36,18% e 35,46%, respectivamente, superior ao MGS (27,68%). Para os valores de FDN utilizando GCG e DDGS, foram observados valores de 51,39% e 65,47%, respectivamente, menores ($P<0,05$) que MGS (70,72%). O uso de inoculante microbiano e ácido não alterou ($P>0,05$) os valores de MO, com valor médio de 92%. Quanto à PB, não houve interação ($P>0,05$) de sequestrantes de umidade,

inoculante microbiano e/ou ácido. Recomenda-se incluir alimentos sequestrantes de umidade associados ao MGS para obter melhores valores de MS, FDN e PB após abertura do saco e o uso de inoculantes microbianos e/ou ácidos no MGS não influenciou essas características.

Palavras-chave: matéria seca, proteína bruta, *Megathyrus*, fibra detergente neutro.

RESUMEN

El objetivo de este trabajo fue evaluar las características químicas del ensilaje de pasto Miyagi (*Megathyrus maximus* cv. Miyagi), con la adición de secuestrantes de humedad (grano de maíz molido - GCG, y grano seco de destilería con solubles y alto contenido de fibra, DDGS), y adición de inoculante (SiloSolveMC) y/o ácido (Mold-Nil Liquid). El diseño experimental fue completamente al azar en un arreglo factorial 3x3, con cinco réplicas: factor 01, el uso de secuestradores de humedad (sin aditivo, con la adición de GCG y/o DDGS), y factor 2, el uso de inóculo bacteriano (SiloSolveMC) y/o ácido (Mold-Nil Liquid). Para la evaluación química del ensilaje se evaluó el porcentaje de materia seca (MS), la fibra insoluble en detergente neutro (FDN), el contenido de materia mineral (MM) y la proteína cruda (PC). No hubo interacciones entre secuestradores de humedad, inóculos bacterianos y/o ácidos. El uso de secuestradores de humedad interfirió en la MS ($P<0,05$), observándose un valor con el uso de GCG y DDGS de 36,18% y 35,46%, respectivamente, superior al MGS (27,68%). Para los valores de FDN utilizando GCG y DDGS se observaron valores de 51,39% y 65,47%, respectivamente, menores ($P<0,05$) que MGS (70,72%). El uso de inóculo microbiano y ácido no alteró ($P>0,05$) los valores de MO, con un valor promedio de 92%. En cuanto a PC, no hubo interacción ($P>0,05$) de secuestradores de humedad, inóculo microbiano y/o ácido. Se recomienda incluir alimentos secuestradores de humedad asociados a MGS para obtener mejores valores de MS, FDN y PC después de la apertura de la bolsa y el uso de inóculos microbianos y/o ácidos en el MGS no influyó en estas características.

Palabras clave: materia seca, *Megathyrus*, proteína cruda, fibra detergente neutro.

1 INTRODUCTION

Brazilian Agricultural Research Corporation (Embrapa) studies reveal that Brazil, boasting the world's largest cattle herd, held this title in 2020 with a staggering 217 million heads, representing 14.3% of the global herd. Additionally, Brazil is the leading meat exporter, accounting for 2.2 million tons and 14.4% of the international market (Embrapa, 2021).

However, the majority of the Brazilian cattle herd is raised in an extensive pasture system. In Brazil, around 90% of the national herd production is included in this modality, which uses the nutrients from the pasture as a source of supplies for the development of animals. However, there is a dry season, when forage production is seasonal, which can result in a shortage of food and nutrient sources for the animals. It is for this reason that food conservation practices using the ensiling method are becoming more common. It consists of a technique that allows food to be preserved in an anaerobic environment, which makes it possible to provide food for animals during periods of reduced forage supply, during dry periods of the year, with less rainfall.

The ensiling process, a key food conservation practice, effectively preserves forage from

deterioration through anaerobic fermentation. This process involves cutting and chopping the forage, storing it in a bag, and mechanically compacting the ensiled material using appropriate equipment. The bag is then sealed with tarpaulins to prevent the entry of oxygen. Once sealed, the process of converting soluble carbohydrates into lactic acid begins, lowering the pH of the ensiled mass to levels that inhibit microbial activity, thereby preserving its characteristics (Kipert *et al.* 2018).

However, the forages most used in silage production are corn (*Zea mays*) and sorghum (*Sorghum bicolor* L. Moench); however, silage of grasses from tropical climates, made from permanent pastures, has proven to be a viable and safe alternative for the production of roughage (Vieira, 2010; Silva *et al.* 2024).

Among the forages belonging to the *Megathyrsus* genus, the most used in Brazil for silage production are Mombaça, Tanzania, BRS Zuri, and Massai. These cultivars have a crude protein content that varies from 12% to 16% of dry matter, while dry matter (DM) production can reach 6 to 44 tons/ha/year, depending on soil and climate conditions and crop management (Cândido and Fortunato, 2020).

Moreover, recently, Miyagi grass (*Megathyrsus maximus* cv. Miyagi) was launched. Its average production of DM (dry matter) is between 25 and 30 t/ha/year, with crude protein levels between 8 and 14% in MS, depending on the time of year. However, like other grasses of the genus *Megathyrsus maximus*, it does not have levels of dry matter and soluble carbohydrates that provide adequate fermentation for ensiling.

According to Hansen (2014), the use of a bacterial-based inoculant, the commercial product SiloSolve MC, is intended to control fermentation and microorganisms responsible for silage deterioration. It is composed of the following maltodextrin bacteria: sodium aluminosilicate, dehydrated product from the fermentation of *enterococcus faecium*, dehydrated product from the fermentation of *Lactobacillus plantarum*, dehydrated product from the fermentation of *Lactococcus lactis*, tartrazine dye and brilliant blue dye, which assists in proper fermentation during ensiling.

According to Corrêa (2020), mold-nil liquid acid is used as a fungal growth inhibitor, which results from the unique synergistic mixture of active ingredients that are used to combat mold and fungi. They are of paramount importance as the quality of the silage is determined by its composition and the microbial load it has. The number of fungal spores and mycotoxin production are important factors, and the acid works to inhibit them, thus keeping the silage palatable and with high nutritional values.

Given this statement, the present study becomes relevant to the suitability of using Miyagi grass silage. There is an inconsistency and lack of results on the use of grass for silage. In the present

work, moisture sequestrants were added (ground corn grain, GCG, and dry distillers grain with soluble and high fiber, DDGS), and addition of microbial inoculant (SiloSolveMC) and/or acid (Mold-Nil Liquid) in the Miyagi grass silage which are fermentation stimulants that will help in the fermentation process, preserving the mass that was ensiled and gradually reducing losses during the process.

The objective was to evaluate the chemical characteristics after opening the Miyagi grass silage (*Megathyrsus maximus* cv. Miyagi), with the addition of moisture sequestrants (GCG and DDGS) and the use of microbial inoculants (SiloSolveMC) and/or acid (Mold-Nil Liquid).

2 METHODOLOGY

The experiment was conducted at the Federal Institute of Rondônia, Campus Colorado do Oeste, located at BR 435 Km 63, and the laboratory analyses were carried out in the exact location. Miyagi grass (*Megathyrsus maximus* cv. Miyagi) was used to carry out ensiling from the planting area of the Minuano farm, based in the municipality of Pimenta Bueno-RO. The Miyagi grass variety has a perennial cycle, with a cespituous plant with erect growth, medium to tall size (2.5 m), and intense tillering. Its leaves can reach 5 to 120 cm in width. Its flowering cycle is medium, and it produces a large number of seeds, with an average production of dry matter between 25 and 30 t/ha/year and crude protein between 8 and 14% in dry matter, depending on the time of year. Table 1 presents the chemical characterization of the varieties evaluated before ensiling (Miyagi grass, GCG, and DDGS).

Table 1. Chemical characterization of the varieties evaluated before ensiling (Miyagi grass; ground corn grain, GCG; and dry distillers grain with solubles and high fiber, DDGS).

Variables	Miyagi grass	GCG	DDGS
DM ¹ (%)	27.02	87.01	91.53
MM ² (% DM)	6.87	8.27	4.19
NDF ³ (% DM)	64.34	12.25	43.67
CP ⁴ (% DM)	7.51	6.23	18.37

¹ Dry matter percentage. ² Mineral matter. ³ Neutral detergent fiber. ⁴ Crude protein. Fonte: Elaborado pelos autores (2024)

The grass was harvested and ensiled using a self-propelled forage harvester. The entire plant was then ensiled. The experiment was carried out to evaluate the effects of the bacterial inoculant and acid (Mold-Nil Liquid—Adisseo) associated with moisture sequestrants ground corn grain and high fiber DDGS with Miyagi grass silage.

The bacterial inoculant found in the commercial product SiloSolve MC is intended to control fermentation and microorganisms responsible for silage deterioration. It is composed of the following maltodextrin bacteria: sodium aluminosilicate, a dehydrated product from the

fermentation of enterococcus faecium, a dehydrated product from the fermentation of *Lactobacillus plantarum*, a dehydrated product from the fermentation of *Lactococcus lactis*, tartrazine dye, and brilliant blue dye.

Mold-Nil Liquid Acid is used as a fungal growth inhibitor, which results from the unique synergistic mixture of active ingredients that are used to combat mold and fungi. They are of paramount importance as the quality of the silage is determined by its composition and the microbial load it has. The number of fungal spores and mycotoxin production are important factors, and the acid works to inhibit them, thus keeping the silage palatable and with high nutritional value.

The experimental design was completely randomized in a 3x3 arrangement with five replications, with 45 experimental units, with factor 01, the use of moisture sequestrants (without moisture sequestrant, with the addition of GCG and/or DDGS), and factor 02, the use of inoculant (bacterial) and/or acid (Mold-Nil Liquid).

The experimental units consisted of experimental bags (buckets) with a volume of 10 and 12 L, equipped with screw caps, all equipped with “siphon” type valves to allow air to escape and prevent gases from entering the bag.

The experimental bags had two types of buckets, each filled with enough forage to obtain a density of 600 kg/m³ of green mass. This corresponded to an average of approximately 6.0 kg in a 10L volume bucket of forage, and in buckets with a capacity of 12 L, approximately 7.2 kg of forage were packed per bucket.

The forage was crushed in a self-propelled harvester into particles measuring up to 5.0 cm immediately before ensiling.

The chopped material was divided into three treatments of factor 01, the first without the use of a hygroscopic additive, the second with the use of a hygroscopic additive, ground corn grain, in a proportion of 8.5 kg of ground corn grain, GCG each 30 kg of forage, and thirdly using a hygroscopic DDGS additive, in a proportion of 4.14 kg of DDGS for every 30 kg of forage.

Moreover, each factor 01 was subdivided to carry out the treatments of factor 02 without adding acid and/or inoculant, with the addition of bacterial inoculant, which was treated at a dose of 1% (1 ml for every 1 kg of forage), and with the addition of acid (Mold-Nil Liquid – Adisseo) which was treated in the same proportion as the inoculant.

The inoculant was diluted in water, in a proportion of 0.5 ml inoculant for 25 ml of distilled water. Moreover, the acid was also diluted in water, in the proportion of 15 ml of acid in 15 ml of distilled water. It was applied to the forage using a container with a spray nozzle. Portions of 30 kg of material to be ensiled were treated to ensure immediate use and filling of the bags, reducing damage to the microorganisms in the inoculant and also acidification to those treated with the acid.

All materials and utensils were previously sterilized with 96% alcohol, and all procedures were carried out using gloves for non-surgical procedures.

Forage compaction was carried out manually. After filling each bag, they were closed, and the edges of each lid were sealed with a layer of expanding foam to ensure complete sealing. The “siphon” valves were filled with water in order to prevent the entry of gases. The bags remained closed for a period of (70 days) the opening was carried out on July 5, 2022. During this period, the bags were sheltered in a ventilated place and without direct incidence of light

When the bags were opened, samples were collected in the geometric center of the experimental bag, disregarding 5 cm from the upper and lower portions. At the time of ensiling and opening the experimental bag, forage and silage samples were collected and divided into two sub-samples. The first part was stored in a plastic bag. The end and the second parts were used to determine the percentage of dry matter (DM), and then the broma analysis of the silage was conducted.

To determine the dry matter (DM) of the subsamples, they were dried in a forced air ventilation oven at 65°C for 72 hours (INCT 2012), subsequently ground on 2 mm and 1 mm Willey-type mills, and used as follows to determine the chemical composition.

Using the methodology proposed by INCT (2012), the dry matter (DM), mineral matter (MM), neutral detergent fiber (NDF), and crude protein (CP) contents were determined.

To determine dry matter (DM), after grinding the samples, samples from the 2mm mesh were used. They were weighed every 1g in the crucible, with two repetitions of each treatment, and sent to an oven for 24 hours at a temperature. After that, they were placed in the desiccator with silica gel for around 0 minutes for subsequent drying, thus determining the DM content.

Mineral matter (MM) is determined by interaction at high temperatures, the same as that obtained after burning organic matter. Subsequent samples from the ASE were used, with two replications, stored in a muffle furnace at 600°C for the neutrals.

The neutral detergent fiber (NDF) contents were determined using non-woven fabric—gs (TNT—made of 100 g/m²), 100% Poland propylene, containing 20 mg DM/cm², dipped in a neutral detergent solution containing thermostable alpha-amylase. (Van Soest *et al.* 1991), autoclaved at 105°C for one hour (Pell and Schofield 1993).

To determine crude protein (CP), 200 mg of the air-dried sample was weighed in two repetitions and placed in duly identified tubes. Then, 2 grams of the digesting mixture of sodium sulfate and 5 ml of H₂SO₄ were added. The first stage was digestion; the tubes were added to the digester blocks and heated slowly until reaching a temperature of 400°C. They were kept at that

temperature until the solution was translucent; the digester block remained in a fume hood with an exhaust fan on during digestion.

The tubes were removed and left in the hood to cool when the temperature of the tubes was below 100°C, adding a small portion of distilled water. Then, 20 ml of boric acid solution was added to an Erlenmeyer flask with a capacity of 250 ml, and the Erlenmeyer flask was coupled to the distiller set to receive the distilled ammonia. The tubes with the digested sample were coupled to the distiller, and 25 ml of NaOH solution (500 g/L) was added to distill a volume of 100 ml into the Erlenmeyer flask with a boric acid solution, and then the titration with hydrochloric acid, to determine the nitrogen concentration and CP content of the analyzed sample.

The variables were analyzed using the GLIMMIX procedure of the statistical software SAS (Statistical Analysis System), version 6.12. Moreover, the F-test defined the main effects of the interaction effects were declared significant when $P < 0.01$.

3 RESULTS

The absence of interaction ($P > 0.01$) between moisture sequestrants and the use of bacterial inoculant and/or acid (Table 2), and the lack of isolated effect ($P > 0.05$) with the use of the inoculant microbial and/or acidic (Table 4) are notable. However, the inclusion of moisture sequestrants notably elevated the dry matter content of the ensiled material (Table 3), underscoring their potential to enhance silage quality.

Table 2. Chemical composition of Miyagi grass silage (MGS) with the use of moisture sequestrants (ground corn grain, GCG; and/or dry distillers grain with solubles and high fiber, DDGS), and addition of inoculant (SiloSolveMC) and/or acid (Mold-Nil Liquid) after opening the bag.

Variables	MGS			MGS+ GCG			MGS + DDGS			SEM	P-value		
	Control	Inoculant ⁵	Acid ⁶	Control	Inoculant ⁵	Acid ⁶	Control	Inoculant ⁵	Acid ⁶		Silage	Additive	SxA
DM ¹ (%)	26.63	28.29	28.12	36.15	35.69	36.71	36.01	34.59	35.79	1.228	<0.01	0.57	0.51
OM ² (%)	92.10 ^{bcd}	92.10 ^{bcd}	91.67 ^{cd}	93.95 ^a	92.63 ^{bc}	92.92 ^b	92.62 ^{bc}	91.55 ^d	91.51 ^d	0.033	<0.01	<0.01	0.04
NDF ³ (%)	71.39	71.97	68.80	50.28	54.47	49.42	62.97	66.71	66.75	1.679	<0.01	<0.01	0.06
CP ⁴ (%)	6.55	6.77	6.70	8.25	8.88	8.82	14.28	13.98	12.73	0.672	<0.01	0.50	0.24

Means followed by the same letter on the line do not differ from each other using the Tukey test with a probability greater than 0.05. ¹ Dry matter; ² Organic matter; ³ Neutral detergent fiber; ⁴ Crude protein; ⁵ Inoculant – SiloSolveMC; ⁶ Acid - Mold-Nil Liquid®. Fonte: Elaborado pelos autores (2024)

Considering these findings, the dry matter contents observed for all treatments fell within the range of 26 and 36%, with the most favorable values achieved when using moisture sequestrants such as GCG and DDGS. These treatments yielded dry matter content values of 36, 18 and 35.46%, respectively (Table 3), aligning with the ideal range for high-quality silage. The use of moisture sequestrants played a significant role in achieving these results, as evidenced by the observed interaction ($P < 0.05$) with the organic matter contents (Table 2).

Table 3. Chemical composition of Miyagi grass silage (MGS) with the use of moisture sequestrants (ground corn grain, GCG; and/or dry distillers grain with solubles and high fiber, DDGS) after opening the bag.

Variables	MGS	MGS + GCG	MGS + DDGS	SEM	P-value
DM ¹ (%)	27.68 ^b	36.18 ^a	35.46 ^a	0.709	<0.01
OM ² (%)	91.95 ^b	93.16 ^a	91.89 ^b	0.175	<0.01
NDF ³ (%)	70.72 ^a	51.39 ^c	65.47 ^b	0.969	<0.01
CP ⁴ (%)	6.67 ^a	8.65 ^b	13.66 ^c	0.274	<0.01

Means followed by the same letter on the line do not differ from each other using the Tukey test with a probability greater than 0.05. ¹ Dry matter; ² Organic matter; ³ Neutral detergent fiber; ⁴ Crude protein. Fonte: Elaborado pelos autores (2024)

In terms of organic matter, the treatments involving moisture sequestrants and the addition of additives with inoculants and/or acid demonstrated a significant interaction ($P < 0.05$). Notably, MGS with GCG without inoculant and/or acid yielded the highest organic matter value, underscoring the beneficial impact of moisture sequestrants on preserving the nutritional value of silage.

For the neutral detergent fiber (NDF) fraction, forages are comprised of hemicellulose, cellulose, lignin, cutin, and silica, all of which form the NDF fraction (Van Soest, 1994).

The values obtained for NDF were not significant ($P > 0.05$) for the interaction between moisture sequestrants and the use of microbial inoculant and/or acid (Table 2). However, when analyzing the effect of moisture sequestrants, GCG and DDGS, on MGS, GCG provided the lowest NDF value (51.39% of DM), and DDGS provided the intermediate value (65.47% of DM). Compared to MGS (Table 3).

Crude protein (CP) consists of substances with some chemical similarities but with different biochemical and physiological functions.

Regarding the crude protein content of the silages, there was no interaction ($P > 0.05$) between moisture sequestrants and the use of microbial inoculant and/or acid (Table 2), and there was also no isolated effect of the inoculant and/or acid (Table 4).

Table 4. Chemical composition of Miyagi grass silage (MGS) with addition of inoculant (SiloSolveMC) and/or acid (Mold-Nil Liquid®) after opening the bag.

Variables	Control	Inoculant ⁵	Acid ⁶	SEM	P-value
DM ¹ (%)	32.93 ^a	32.85 ^a	33.54 ^a	0.709	0.57
OM ² (%)	92.89 ^a	92.09 ^b	92.03 ^b	0.175	<0.01
NDF ³ (%)	61.54 ^b	64.38 ^a	61.66 ^b	0.685	<0.01
CP ⁴ (%)	9.69 ^a	9.87 ^a	9.41 ^a	0.388	0.50

Means followed by the same letter on the line do not differ from each other using the Tukey test with a probability greater than 0.05. ¹Dry matter; ²Organic matter; ³Neutral detergent fiber; ⁴Crude protein; ⁵Inoculant – SiloSolveMC; ⁶Acid - Mold-Nil Liquid®. Fonte: Elaborado pelos autores (2024)

4 DISCUSSIONS

According to Coan *et al.* (2007), to obtain good-quality silage, a minimum dry matter content of 25% is sufficient to avoid damaging the fermentation process. The dry matter content considered ideal for the ensiling process is between 28 and 34% (Monteiro *et al.* 2011; Santos *et al.* 2024).

This increase in dry matter content can be explained by the use of foods with DM contents above 86%. When mixed in an ideal proportion with forage, these foods promote the best dry matter value for fermentation in the bag and preserve the forage characteristics.

The contents of organic matter and mineral matter are inversely proportional; one interferes with the other, and when one decreases, the other increases; the analysis of (OM) is based on the analysis of mineral matter (MM). Moreover, they are indicative of better forage conservation, as when there is inadequate fermentation, losses of organic matter occur, increasing the relative participation of ash (mineral matter) in DM% (Pereira *et al.* 2004).

Recently, research has sought new alternatives, with the aim of minimizing losses resulting from ensiling, optimizing the fermentation process, reducing aerobic deterioration, and preserving the nutritional value of the silage produced. In this sense, the use of bacterial inoculants (Harrison *et al.* 1994) is a technique widely disseminated in developed countries and has aroused great interest among Brazilian producers. However, the results obtained with its use are contradictory since improvements in the fermentative profile of silages are not always accompanied by improvements in chemical composition and/or gains in animal performance, and the opposite is also true (Magalhães and Rodrigues 2003).

The use of bacterial inoculants is recommended to promote fermentation with more efficient production of lactic acid, accelerate the drop in pH, and inhibit undesirable fermentations that deteriorate the silage, such as protein degradation by clostridia (Kung and Ranjit 2001).

A deficiency in soluble carbohydrates reduces the possibility of lactic acid bacteria (LAB) action, resulting in a lower amount of lactic acid. The dilution of acids in the more excellent humidity present in natural forage worsens the problem, making it difficult to reduce the pH.

Therefore, grass silages are prone to secondary fermentations (with more significant DM losses) and the growth of undesirable microorganisms, especially clostridia (Arcuri *et al.* 2004).

Nelson and Moser (1994) and Bueno (2000) explain that increasing age provides tropical grasses with an accelerated process of morphological differentiation, characterized by an increase in supporting tissues present in the stem region and a reduction in tissues related to cellular content, that is, as the plant matures, the production of potentially digestible components tends to decrease, and fiber tends to increase. Moreover, the grass at the time of harvest was in the flowering phase; this is when this drop in the amount of minerals occurs, and inversely provides a higher organic matter content in the forage, associated with the phenological development of the grass, promoting the effect of dilution in the dry matter produced, which may explain the increase in OM levels.

According to McDowell (1985), as the plant flowers and enters a state of maturation, the quality of the forage is interfered with. This is caused by the translocation of soluble carbohydrates from stems and leaves to the influence and seeds, increasing the levels of lignified cell walls and a drop in the leaf-stem ratio.

According to Waldo (1986), the neutral detergent fiber (NDF) content is used to determine forage consumption. However, the content of neutral detergent-insoluble fiber represents a chemical approximation of the insoluble fiber in an aqueous medium, which in the bovine rumen corresponds to a portion of the food that effectively causes a filling effect, as well as in other segments of the gastrointestinal tract (Detmann 2010).

According to Van Soest (1965), they propose an NDF value in roughage for ruminants of up to 55% in dry matter. Therefore, the addition of GCG is more consistent with this aspect.

The GCG was efficient in reducing the fiber content of the silage due to this food having a lower fiber level. As for the DDGS, even if it is classified as a concentrated feed, the fiber level is higher, reducing the possibility of deducting the fiber concentration of the MGS as the GCG.

Even if it is bulky feed, reducing the fiber content of the silage can be considered advantageous, as high proportions of cell wall constituents, mainly lignin, can reduce the animal's consumption, compromising its performance (Wilson 1994).

Thus, with the use of ground corn grain moisture sequestrant in Miyagi grass silage, average NDF values of 51.39% were observed, regardless of the use of microbial inoculant and acid additives. This is ideal for ruminants and does not exceed the limit of up to 55% NDF in dry matter proposed by Van Soest (1965) in a strategy of only using silage in feeding ruminants.

Nitrogen is the most distinctive property element present in proteins. The nitrogen content comes not only from proteins but also from other components such as nucleic acids, amines, free amino acids, etc. (Gomes and Oliveira 2011). The fluctuations in CP values ranged from 6 to 13%.

However, for the addition of moisture-sequestering foods independent of the use of microbial inoculant and/or acid, MGS with the addition of DDGS had an increase with an average CP value of 13%, compared to MGS and MGS with GCG, as the DDGS is considered a protein source, which is highlighted in a study carried out by Jie *et al.* (2013), where they evaluated the chemical composition of several DDGS samples, and presented a crude protein content of between 20%, with this value it can be considered as a protein source, which may explain the increase in the CP value of MGS with addition of DDGS.

5 CONCLUSION

Ensiling Miyagi grass is a viable alternative due to the silage's chemical characteristics. It is recommended to use moisture-sequestering foods associated with MGS to obtain better DM, NDF, and CP values after opening the bag. Moreover, the use of inoculants and/or acids in the MGS does not influence the chemical chemical characteristics after opening the bag. There is a need to carry out work with acidifier additives at different levels in order to use grass for silage.

ACKNOWLEDGEMENTS

The authors acknowledges the Federal institute of Rondônia, Colorado do Oeste, Brazil

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