USE OF ADDITIVES AND PRE-WILTING IN TIFTON 85 BERMUDAGRASS SILAGE PRODUCTION

Uso de aditivos e pré-emurchecimento na produção de silagem de capim Tifton 85

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ABSTRACT

The use of tropical grasses silage has become common in ruminant feed. An experiment was conducted to evaluate the fermentation characteristics, nutritional value, pH, fermentative capacity, ammonia nitrogen / total nitrogen (NH3N/total N) of Tifton 85 bermudagrass grass silage with different additives and wilting. The treatments were: pre-drying in the sun for two hours before silage, use of inoculant-enzymatic addition of soybean hulls, corn grits addition and use of salt in the surface layer of the silo. The experimental design was completely randomized with 6 treatments and 4 replications. Plants of Tifton 85 bermudagrass with 38 days of growth were ensiled in experimental silos with Bunsen valve type with packing densities of 236 kg of silage per m^3 for Tifton 85 bermudagrass pre-dried in the sun and 294 kg of silage per m^3 for the other treatments. The proportions of soybean hulls and corn grits added to the silage were calculated based on the initial DM content of Tifton 85 bermudagrass order to obtain MS 320 g kg^{-1} for the material to be ensiled. The buffering capacity did not differ between treatments in getting 29.56 (meqHCl/100gMS). It was found that the concentration of ammonia nitrogen did not differ between silages and remained low (3.22 g kg^{-1}), the pH after silo opening was also similar with an average of 4.09 getting above 4.2 only in Tifton 85 bermudagrass silage without pre-treatment. The crude protein was higher in silages Tifton 85 bermudagrass and Tifton 85 bermudagrass with soybean hulls (17.48 g kg^{-1}). The use corn grits caused a reduction in the values of NDF. The use of salt on the surface the layer reduced the production of latic and acetic acid.

Index terms: Acid latic, corn grits, enzymatic-bacterian inoculant, ammonia nitrogen, soybean hulls.

RESUMO

O uso de silagem de gramíneas tropicas tem se tornado comum na alimentação de ruminante. Conduziu-se um experimento com o objetivo de avaliar o perfil fermentativo e valor nutricional da silagem de capim Tifton 85 com diferentes aditivos e emurchecimento. Os tratamentos foram: pré-secagem ao sol por 2 horas antes de ensilar, uso de inoculante bacteriano-enzimático, adição de casca de soja, adição de quirera de milho e uso de sal grosso na camada superficial do silo. O delineamento experimental foi inteiramente casualizado, com 6 tratamentos e 4 repetições. Plantas de capim Tifton 85 com 38 dias de crescimento foram ensiladas em silos experimentais com válvula tipo Bunsen com densidades de compactação de 236 kg de silagem por m^3 para o Tifton 85 pré-seco ao sol e 294 kg de silagem por m^3 para os demais tratamentos. As proporções de casca de soja e quirera de milho, adicionados à silagem, foram calculados com base no teor de MS inicial do Tifton 85 visando à obtenção de MS de 320 g kg^{-1} para o material a ser ensilado. A capacidade tampão não diferiu entre tratamentos ficando em 29,56 (meqHCl/100gMS). Verificou-se que os teores de nitrogênio amoniacal não diferiram entre as silagens e mantiveram-se baixos (32,2 g kg^{-1}), o pH após a abertura dos silos também não diferiu com média de 4,09 ficando acima de 4,2 apenas na silagem de Tifton 85 sem pré-tratamento. Os teores de proteína bruta foram mais elevados nas silagens de capim Tifton 85 e capim Tifton 85 com casca de soja (174,8 g kg^{-1}). O uso de quirera de milho promoveu redução nos valores de FDN. O uso de sal na camada superficial reduziu a produção de ácido acético e lático.

Termos para indexação: Ácido lático, casca soja, inoculante bacteriano-enzimático, nitrogênio amoniacal, quirera milho.

INTRODUCTION

In the recent years, there has been growing interest in the use of perennial grasses for silage production due to the production cost relative to corn crop. The elephant grass was one of the first to be used for silage production of tropical evergreen species, but the Tifton 85 bermudagrass has aroused interest among producers for its versatility in use, currently being widely used in the form of grazing and hay. However, tropical perennial forages commonly used for grazing have limitations to silage process for presenting low content of dry matter (DM) at the optimum cutting point, thus justifying the use of techniques that promote the reduction of moisture at the time of ensiling (Coan et al. 2005).

Obtaining high quality silage requires that certain factors should be considered, for example, dry matter

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Received in june 21, 2013 and approved in december 6, 2013

(DM), which should be between 280 and 350 g kg^{-1}, the soluble carbohydrates from 80 to 120 g kg^{-1} DM and low buffering capacity that does not to provide resistance to lowering the pH to between 3.8 and 4.2 (Woolford, 1984, McDonald et al. 1991; Coan et al. 2005).

Reducing the moisture content of the forage can be made by adding additives with high dry matter content and high absorptive power such as grains and agro-industrial byproducts such as pelleted citrus pulp and soybean hulls. Soybean hulls is obtained before crushing, because before this process is necessary to extract the film that covers the grain, thus generating this co-product of this industry which according to Zambom et al., (2001) presents high adsorption power.

The wilting technique enables then silage of forage plants harvested with low dry matter content in a simple process, in which the fermentation reactions are easily controlled by reducing the water activity (Aw) or high osmotic pressure (McDonald et al., 1991), however the forage requires a period of sun exposure and subsequent payment for silage, which may hinder the process.

An alternative to improving the fermentative pattern of silage would be the use of bacterial additives, added during ensiling forage to stimulate the lactic acid fermentation as a result of low epiphytic microflora present in the tropical perennial grasses at the time of ensiling. The use of salt in the surface layer of the silo has been used in order to prevent losses in the top layer of silage; however there are few studies evaluating the effects on the fermentation profile and nutritional value of the silage. Thus, the present study aimed at evaluating the fermentation profile and nutritional value of Tifton 85 bermudagrass silage under different treatments.

MATERIALS AND METHODS

The experiment was conducted at the State University of West Paraná - Campus Marechal Candido Rondon - PR, under the geographic coordinates 24º 19 ‘S latitude and 54° 01W longitude and 392 m altitude. The local climate is classified according to Koppenas Cfa type, subtropical with well distributed rainfall throughout the year and hot summers. The soil of the region is classified as eutrophic Red Latosol (Embrapa, 2006).

The experimental design was completely randomized with 6 treatments and 4 replications. The treatments were: Tifton 85 bermudagrass silage without additives (Tifton 85 bermudagrass); Tifton 85 bermudagrass silage with added soybean hulls (Tifton 85 bermudagrass + CS); Tifton 85 bermudagrass silage with added corn grits (Tifton 85 bermudagrass + QM); silage Tifton 85 bermudagrass with inoculant (Tifton 85 bermudagrass + IN); Tifton 85 bermudagrass silage with pre sundried (Tifton 85 bermudagrass + sun) and Tifton 85 bermudagrass silage with added salt in the upper layer (Tifton 85 bermudagrass + Sal). The area used to cut and grass silage 85 was a hay field. When the grass had 38 days of vegetative growth and 20 cm in height, on May 16, 2011 it was performed the cut with a mower to 5 cm from the soil and chopping with forage harvester resulting in 3 cm mean particle length.

After determination of the dry matter content of 85 Tifton (250 g kg^{-1}), three days before ensiling was calculated the proportion to be added of soybean hulls and corn grits, which were added at a rate of 120 g kg^{-1} for obtaining a silage dry matter content of 320 g kg^{-1}. In pre drying treatment, after chopped, the material remained for two hours in the sun to dehydration reaching 319.9 g kg^{-1} DM content. The dry matter content obtained after the mixtures were: 286.0 g kg^{-1} of the control, 329.3 g kg-1 in corn grits, 347.4 g kg^{-1} of soybean hulls, 280.5 g kg^{-1} in the inoculant and 285.4 g $kg^{-1}$with salt. For each treatment were prepared 20 kg of silage.

The inoculant (Lacto-silo Gold® Nitral Urban) presented the following security levels reported 1.0 $x10^9$ colony forming units (CFU/g) of: *Lactobacillus curvatus; L. acidophilus; L. plantarum; L. buchineri; Pedicoccusacidilactici; Enterococcus faecium; Lactococcuslactis* and Cellulase 85U/g. The following dilutions were used: 43g of inoculant to 10 liters of water at room temperature and no chlorine; it was applied at a rate of 200 mL per 100 kg of silage. This solution was applied with spraying.

The experimental PVC silos had 10 cm in diameter and 50 cm in height with ‘Bunsen’ type valve caps being placed a 5-cm layer of dry sand autoclaved in the bottom of the silo and separated from silage by cotton fabric, thus flowing the effluent produced. Before ensiling, silage samples were collected from all treatments plus additive samples to determine the chemical composition. Samples of the different treatments were frozen for subsequent determination of soluble carbohydrates content according to the methodology of Lever (1972) and buffering capacity according to Playne and McDonald (1966). On average 2.06 kg silage per silo were packaged resulting in equivalent density to 294 kg of silage per m^3. For the treatment with pre-drying the density was lower with 1.89 kg of silage per silo corresponding to density of 236 kg of silage per m^3. The silos were kept in protected location under room temperature. The buffering capacity was measured according to the methodology of Playne and McDonald (1966).

After 30 days the silos were opened being before weighted. A silage layer of 5 cm from the top and another from the bottom were discarded and the rest of the silage was homogenized for samples withdrawal. Subsequently, the pH was measured by using a potentiometer in the aqueous extract formed by a 25g-fraction of mixed sample with 450 mL of deionized water according to the methodology described by Cherney and Cherney (2003) and silage temperature was measured with a skewer type digital thermometer. The fermentative capacity (CF) was calculated according to the equation proposed by Jobim et al. (2007), CF = MS + 8 (CS/CT); in which the MS is expressed in% soluble carbohydrates (CS) in% of DM and the buffer capacity (CT) in HCl/100 g MS. The dry matter recovery was determined according to Jobim et al (2007), using the following equation: RMS = (MFabxMsab) / MFfexMSfe) * 100.Where: RMS = recovery rate of dry matter; MFab = forage mass at the opening; MSab = DM content in the opening; MFfe = forage mass at closing; MSfe = DM content of the forage at closing.

A 300g portion was dried in oven at 55° C for 72 hours, followed by correction to at 105° C, then weighed and grounded in knife mill with 1 mm sieve for further analysis of dry matter (DM), crude protein (CP) according to AOAC (1990), neutral detergent fiber (NDF), acid detergent fiber (ADF), lignin and cellulose (Silva; Queiroz, 2006). To determine the cellulose was used 72% sulfuric acid (Van Soest, 1994). The hemicellulose contents were calculated by the difference between NDF and ADF, and the lignin by the difference between ADF and cellulose. New analysis of NDF and ADF was performed for, from such wastes, being carried out the analysis of neutral detergent insoluble nitrogen (NDIN) and acid detergent insoluble nitrogen (ADIN).The chemical composition of Tifton 85 bermudagrass before ensiling is showed in table 1.

In the determination of in vitro digestibility of dry matter was adopted the technique described by Tilley and Terry (1963) adapted to the Artificial Rumen as described by Holden (1999).

In the determination of the acids it was used a high-definition HPLC chromatograph Shimadzu® model Pump: LC-20AT, Oven: CTO-20A. The lactic, acetic and butyric AGV were analyzed following to methodology used by Moisio and Heikonem (1994), using the following chromatographic conditions: mobile phase: acetonitrile solution (10%) plustrifluoracetic acid (0.025%), containing added solution of water (90 %) plus 0.05% trifluoracetic

Table 1 – Crude Protein (CP), neutral detergent insoluble protein (NDIP), acid detergent insoluble protein (ADIP), neutral detergent fiber (NDF), acid detergent fiber (ADF), hemicellulose, cellulose and lignin in Tifton 85 bermudagrass before ensiling.

Treatments	CP (g/kg)	NDIP (g/kg CP)	ADIP (g/kg CP)	NDF (g/kg)
Tifton 85	182.26	464.69	458.30	732.16
Tifton 85 + CG	157.61	631.23	593.86	700.20
Tifton 85 + SH	165.57	374.71	485.77	750.24
Tifton 85 + IN	164.51	359.67	534.55	779.62
Tifton 85 + Sun	150.80	402.65	468.68	753.73
Tifton 85 + Salt	162.50	388.39	408.21	776.58
Mean	163.87	420.22	491.56	748.75
	ADF (g/kg)	Hemicellulose (g/kg)	Cellulose (g/kg)	Lignin (g/kg)
Tifton 85	396.27	335.89	320.81	60.31
Tifton 85 + CG	394.07	306.13	316.16	63.58
Tifton 85 + SH	423.67	326.57	338.78	70.85
Tifton 85 + IN	410.40	369.21	319.08	75.81
Tifton 85 + Sun	422.29	331.43	345.45	62.80
Tifton 85 + Salt	418.62	357.96	338.27	66.06
Mean	410.89	337.86	329.76	66.57

CG: corn grits, SH: soybean hulls, IN: inoculant; Sun: Pre sun drying; Salt: salt on the surface of the silos.

acid, oven temperature of 47° C, 0.6 mL/min flow and 208 nm wavelength.

The samples and dilutions to obtain the calibration curves were prepared in volumetric balloon (5ml) and acidified with 2 µl of sulfuric acid solution (2M). Then, the samples were filtered a membrane with 0.22 µm porosity. Calibration curves were prepared using a solution containing all acids of interest and known concentration (1g L^{-1}). From this stock solution, aliquots were removed and diluted in water. Dilutions were made at each point in duplicates. The quantification of acids was performed using the external standard method, in which the mass percentage of a sample of unknown concentration is determined from a calibration graph. The dilutions for curves were prepared at six different concentrations: 17.5, 35, 75, 150, 375, 700 mg L^{-1}. Samples with 200g were placed into plastic bags properly identified and frozen. Subsequently, it was determined the ammonia $N\text{-}NH_3$ by the methodology of Bolsen et al. (1992).

During the pre-drying of Tifton 85 bermudagrass, the climatological data were: air temperature (ºC): mean - 15.9; maximum - 23.1; minimal – 10.1. Relative humidity (%): mean - 80.3; maximum - 98.0, minimum - 50.0. Atmospheric pressure (kPa): mean - 970.9; maximum - 972.5; minimal - 969.9. Wind (m/s): Speed - 2.5 and Blast - 7.8; Radiation (KJ/m^2): 17379.100 and rain (mm): 0.0.

The data were STATISTICALLY ANALYZED USING THE PROGRAM - SAEG (1997), and the treatments were compared by the Tukey test at 5% probability.

RESULTS AND DISCUSSION

The treatments added to corn grits, soybean hulls and pre sundried before ensiling showed contents above 300g kg^{-1} DM (Table 2). The Tifton 85 bermudagrass plus soybean hulls had higher dry matter 347.43 g kg^{-1} (P <0.05) compared to the other treatments (Table 1), and all treatments were within the appropriate range to allow a proper fermentation and prevent undesired fermentation which occurs in fodder silages with DM levels below 250.0 g kg^{-1} compromising the nutritional value of the silage. The highest values of dry matter in silage plus soybean hulls is due to high water retention of this additive being considered by Zambom et al (2001) a good absorbent additive.

According to Mc Donald et al (1991), the ideal for the ensilage process is that the material has DM content between 300 and 350 g $kg^{-1}$and, for contents between 400 to 450g kg^{-1} is recommended that the material is chopped into smaller particles in order to achieve better compression.

Silages prepared with corn grits and use of inoculants showed higher soluble carbohydrates contents (P<0.05), however below the recommended levels for good production of lactic acid, because these carbohydrates act as substrate for lactic bacteria favoring the production of lactic acid and thus reducing the pH faster (Table 2). The recommendation for a good fermentation is that these carbohydrates are above 80g kg^{-1} (McDonald et al. 1991).The soluble carbohydrates are usually low in the tropical grasses silage, between 20 to 50 g kg^{-1} dry matter, according to results of Rodrigues et al (2003) with contents of 52.0 g kg^{-1} of soluble carbohydrates in elephant grass silage and Ribeiro et al. (2009) in silage Marandu grass with the use of preservatives, soluble carbohydrate contents ranged from 22.0 to 33.0 g kg^{-1}.

No significant difference was observed (P> 0.05) for the fermentative capacity among the treatments. The mean pH was 5.89 with Tifton 85 bermudagrass, with pre sun drying with higher pH values and Tifton 85 bermudagrass plus corn grits lower values (Table 2).

Concerning to the buffering capacity, there was no difference (P> 0.05) between treatments getting on average 29.56 meq/100g DM, these values are considered low and therefore not providing plant resistance to pH drop as can be seen in the pH final values pH attained in table 2.

The stages of the fermentation process laston average 21 days and changes in the nutritional value of the silage may occur due to microbial activity and changes in temperature. After opening the silos, dry matter contents ranged between silages (Table 3). The Tifton 85 bermudagrass grass silage plus soybean hulls had higher levels of DM (38.75 g kg^{-1}) followed by Tifton 85 bermudagrass plus corn grits keeping the same trend obtained before ensiling. Andrade et al. (2012) obtained with the addition of 100g kg^{-1} of soybean hulls and corn meal, increases of 340 and 370 g kg^{-1} DM in the elephant grass silage with 80 days of regrowth compared to elephant grass silage without additives, showing in this essay that the corn meal showed higher absorbency compared to corn grits which was used in this test.

The ammoniac nitrogen was not different between treatments (P> 0.05) with 3.23% NH3/total N (Table 3), these values being considered low and indicating a lower rate of proteolysis and deamination, resulting from control of undesirable microorganisms (McDonald et al. 1991). Castro (2006) found that direct ensiling of forage of Tifton 85 bermudagrass (*Cynodon* sp.) without wilting, produced lower quality silage, characterized by high content of ammoniac nitrogen and low aerobic stability.

Table 2 – Content of dry matter (DM) and soluble carbohydrates (CHO), buffer capacity, fermentation power and pH of Tifton 85 bermudagrass with additives before ensilage.

Treatments	Dry matter (g kg^{-1})	CHOsol (g kg^{-1})	Buffer capacity (meq/100gMS)	Fermentation capacity (g kg^{-1})	pH
Tifton 85	285.98c	20.2b	28.00^{ns}	29.3^{ns}	5.93a
Tifton 85 + CG	329.35b	24.1a	29.20	30.6	5.73b
Tifton 85 + SH	347.43a	19.4b	32.93	25.6	5.88a
Tifton 85 + IN	280.53c	23.9a	29.87	27.9	5.90a
Tifton 85 + Sun	319.88b	20.7b	29.19	29.1	5.98a
Tifton 85 + Salt	285.65c	20.3b	28.18	26.5	5.93a
Mean	30.81	21.43	29.56	2.82	5.89
CV (%)	2.56		11.64	16.64	0.78

^{ns} No significant. Means followed by the same letter in the column do not differ by theTukey test at 5% probability. CG: corn grits, SH: soybean hulls, IN: inoculant; Sun: Pre sun drying; Salt: salt on the surface of the silos. CHOsol = soluble carbohydrates.

Table 3 – Dry matter content (DM), pH, ammonia nitrogen (total N/NH_3), and silage dry matter recovery of Tifton 85 bermudagrass with additives.

Treatments	Dry matter (g kg^{-1})	pH	N/NH_3	DM recovery(g kg^{-1})
Tifton 85	302.4c	4.24^{ns}	3.19^{ns}	800.1^{ns}
Tifton 85 + CG	355.4b	4.08	3.36	817.8
Tifton 85 + SH	387.5a	4.16	3.52	844.8
Tifton 85 + IN	296.6c	4.00	3.28	798.2
Tifton 85 + Sun	351.0b	4.08	3.32	807.5
Tifton 85 + Salt	307.3c	4.01	2.71	813.5
Mean	333.3	4.09	3.23	
CV (%)	3.86	2.65	15.03	4.91

^{ns}No significant. Means followed by the same letter in the column do not differ by theTukey test at 5% probability.CG: corn grits, SH: soybean hulls, IN: inoculant; Sun: Pre sun drying; Salt: salt on the surface of the silos.

The pH values were within the range recommended for silage i.e. below 4.2 except in Tifton 85 bermudagrass silage without application of pretreatment (4.24) but very close to the one desired (Table 3).

Silages with low content of ammoniac nitrogen, i.e. less than 10 NH3 / total N indicates that the fermentation process did not result in excessive hydrolysis of the protein, transforming it into ammonia and amino acids in this situation constitute the majority of non-protein nitrogen used as a source of NH3 production by *Costridium* NH3 (Vansoest, 1994; Coan et al. 2005). Unlike, ammoniac nitrogen content exceeding 15% NH3 of total nitrogen means that protein breakdown was considerable (Coan et al. 2005).

According to McDonald et al. (1991), a good silage is considered satisfactory when presenting pH below 4.2, butyric acid levels lower than 2g kg^{-1} (only obtained in the inoculated silage) in DM, and ammoniac N less than or equal to 11 - 12% NH3 of total N.

The dry matter recovery was 813.6 g kg^{-1} on average not differing between treatments (P> 0.05). Amaral et al. (2007) obtained values of dry matter recovery ranging from 832 to 964 g kg^{-1} in silages of Marandu grass under different compression densities. Quaresma et al. (2010) found no effect of pre wilting on the dry matter recovery in Tifton 85 bermudagrassand grass star ranking 919.8 g $kg^{-1}$for Tifton 85 bermudagrassand 869.8 g kg^{-1} for the grass star.

The temperature recorded in silos after opening did not differ among treatments (P> 0.05) with mean of 21.37° C and room temperature of 20.8° C.

The organic acid contents varied between treatments with higher production of acetic acid in silage of Tifton 85 bermudagrass, Tifton 85 bermudagrass plus soybean hulls and Tifton 85 bermudagrass with pre-drying in the sun (Table 4). The lower production of acetic acid in the treatment Tifton 85 bermudagrass bermudagrass with salt remaining at 23.91 g kg^{-1} DM and, according to Dulphy and Demarquilly (1981), one may consider good silage when the values of acetic acid are below 20 g kg^{-1} DM. Bernardes, Reisand and Moreira (2005) points out that this concept does not apply today because as the strategy of restricting the formation of acetic acid increases the risk of silages being unstable during the aerobiose. In other treatments the acetic acid concentration was above 40 g kg^{-1} DM.

The lactic acid production was higher in the Tifton 85 bermudagrass silage with soybean hulls and corn grits despite the soluble carbohydrates having been higher in the treatments Tifton 85 bermudagrass plus corn grits and Tifton 85 bermudagrass with inoculant (Table 2) this higher production can be related with the presence of lactic acid bacteria in these treatments. According Driehuis et al. (2000), the main objectives of using homofermentative bacteria in silage include reducing the risk of proliferation of bacteria of the genus *Clostridium* thereby reducing the production of butyric acid.

We observed higher levels of crude protein in Tifton 85 bermudagrass silage plus soybean hulls and Tifton 85 bermudagrass with values of 176.43 and 173.34 g kg^{-1} respectively (Table 5). Evangelista et al. (2000) evaluating the effects of wilting on the chemical composition of star grass silage (*Cynodonnlemfluensis*Vanderyst) observed increased pH and contents of ash, calcium and phosphorus and, reduction in the content of neutral detergent fiber (NDF) with increased DM content of the forage. The crude protein, acid detergent fiber (ADF) and gross energy (GE) contents were not affected by wilting. Assessing the impacts of wilting on silage fermentation and digestibility of Tifton 85 bermudagrass, Umanã et al. (1991) concluded that the wilted forage improved the nutritive value of silage.

The neutral detergent insoluble protein (NDIP) showed no significant difference between treatments (P> 0.05), with mean of 288.48 g kg^{-1} CP. Evangelista et al. (2010) considers conflicting the results of pre drying of forage to be ensiled because while it may reduce the action of *Clostridium* and improve the aerobic stability of silage, the warming may cause the formation of indigestible compounds such as NDIP due to the Maillard reaction.

The acid detergent insoluble protein (NDIP) was higher in silage of Tifton 85 bermudagrass with value of 524.86 g kg^{-1} CP, followed by Tifton 85 bermudagrass plus salt with 469.42 g kg^{-1} CP. However, it was found that silage of Tifton pre dried in the sun showed lower levels of NDIP compared to other treatments.

The neutral detergent fiber (NDF) was lower in Tifton 85 bermudagrass silage added with corn grits and use of inoculants. The acid detergent fiber (ADF) was higher in Tifton 85 bermudagrass with pre sundried and lower in Tifton 85 bermudagrass with inoculant.

In the treatments Tifton 85 bermudagrass with pre-drying, Tifton 85 bermudagrass with salt and Tifton 85 bermudagrass with inoculant, the hemicellulose values were lower. Highest values were observed in the Tifton 85 bermudagrass treatments with corn grits 318.78 g kg^{-1} and Tifton 85 bermudagrass with soybean hulls 311.72 g kg^{-1}. The cellulose and lignin did not differ statistically among treatments with mean of 365.34 g kg^{-1} for cellulose and 48.20 g kg^{-1} for lignin.

Table 4 – Organic acids produced in Tifton 85 bermudagrass grass silage (g kg^{-1} DM).

Silages	Acetic acid	Lactic acid	Butyric acid
Tifton 85	45.29a	73.08bc	0.82b
Tifton 85 + CG	41.60ab	102.77a	0.59bc
Tifton 85 + SH	57.64a	100.41ab	0.47c
Tifton 85 + IN	41.66ab	70.78c	0.04d
Tifton 85 + Sun	42.38a	70.28c	1.70a
Tifton 85 + Salt	23.91b	30.12d	0.75bc
CV	18.78	17.26	19.82

[ns]Not significant. Means followed by the same letter in the column do not differ by theTukey test at 5% of probability. CG: corn grits, SH: soybean hulls, IN: inoculant; Sun: Pre sun drying; Salt: salt on the surface of the silos.

Table 5 – Crude Protein (CP), neutral detergent insoluble protein (NDIP), acid detergent insoluble protein (PIDA), neutral detergent fiber (NDF), acid detergent fiber (ADF), hemicellulose, cellulose and lignin of silage Tifton 85 bermudagrass with additives.

Treatments	CP (g kg^{-1})	NDIP (g kg^{-1} CP)	ADIP (g kg^{-1} CP)	NDF (g kg^{-1})
Tifton 85	173.34a	298.66^{ns}	524.86a	721.91a
Tifton 85 + CG	157.58b	284.74	364.94ab	612.18c
Tifton 85 + SH	176.43a	264.63	391.09ab	672.07b
Tifton 85 + IN	163.46b	289.17	347.71ab	649.82bc
Tifton 85 + Sun	161.48b	242.35	253.83b	674.64b
Tifton 85 + Salt	157.78b	351.33	469.42ab	684.25b
Mean	165.01	288.48	391.98	702.15
CV (%)	2.45	21.62	29.79	3.74
Treatments	ADF (g kg^{-1})	Hemicellulose (g kg^{-1})	Cellulose (g kg^{-1})	Lignin (g kg^{-1})
Tifton 85	426.30ab	295.62ab	361.96^{ns}	49.83^{ns}
Tifton 85 + CG	403.40ab	318.78a	359.05	48.38
Tifton 85 + SH	408.35ab	311.72a	350.54	43.19
Tifton 85 + IN	396.38b	253.44bc	337.91	42.47
Tifton 85 + Sun	445.87a	228.77c	381.48	52.01
Tifton 85 + Salt	423.53ab	250.72bc	381.12	53.30
Mean	425.64	276.51	365.34	48.20
CV (%)	4.77	7.95	7.04	15.53

^{ns}Not significant. Means followed by the same letter in the column do not differ by theTukey test at 5% of probability.CG: corn grits, SH: soybean hulls, IN: inoculant; Sun: Pre sun drying; Salt: salt on the surface of the silos.

The *in vitro* dry matter digestibility (IVDMD) was 603,66 g kg^{-1}, showed no significant difference between treatments ($p<0,05$), but there was a trend for higher digestibility in silage with use of inoculant.

Assessing the impacts of wilting on silage fermentation and digestibility of Tifton 85 bermudagrass, Umanã et al. (1991) concluded that the wilted forage improved the nutritive value of silage.

CONCLUSION

The Tifton 85 bermudagrass with dry matter around 280g kg^{-1}can be stored in the form of silage, becoming one alternative of management of this forage due to low pH, low ammonia production and higher crude protein achieved.

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