Effects of Dry Matter Content and Microbial Additive on Tifton 85 *(Cynodon dactylon ssp.)* Wilted Silage Fermentation Parameters

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The XIX International Grassland Congress took place in São Pedro, São Paulo, Brazil from February 11 through February 21, 2001.

Proceedings published by Fundacao de Estudos Agrarios Luiz de Queiroz

Presenter Information

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EFFECTS OF DRY MATTER CONTENT AND MICROBIAL ADDITIVE ON TIFTON 85 (*Cynodon dactylon ssp*.) WILTED SILAGE FERMENTATION PARAMETERS.

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Abstract

The objective of this study was to evaluate the wilting and the addition of a bacterial-enzymatic additive effects on the fermentation parameters of Tifton 85 (*Cynodon dactylon spp*.) silage. Forage was stored as 326 kg bales wrapped with a plastic film. Treatments consisted of 5 forage dry matter levels (20-30%, 30-40%, 40-50%, 50 -60% e 60 a 70%) without additive and 3 dry matter levels (20-30%, 40-50%, e 60-70%) with additive. Buffered propionic acid solution was sprayed onto 60-70% dry matter bales, prior to wrapping, determining an additional treatment. Core samples were taken at 0, 6, 12 hours and 1, 2, 4, 8, 16, and 32 days after wrapping to establish silage pH and temperature trends. Field dry matter losses during the baling process were also evaluated. Bale weight with no additive decreased (364 kg to 254 kg) with increased forage DM content, which in turn resulted in lower bale bulk density (310 to 216 kg/m^3). Lower field DM losses (281 to 177 kg/ha) were associated with higher forage DM content. Final silage pH and temperature peaks were increased at higher DM content, whereas the presence of microbial additive prevented temperature surge.

Keywords: additives, silage, wilting, *Cynodon*, pH, temperature, forage conservation.

Introduction

Tropical forages are known for their seasonal growth pattern and potential biomass yield. Seasonal forage yield distribution represents a great potential for silage and/or hay production. However, low soluble carbohydrates levels and dry matter content are typical in tropical grasses, at appropriate harvesting stage (Umanã et al, 1991; Vilela, 1998). Dry matter losses may arise from secondary fermentations, challenging forage preservation (Vilela, 1998). Wilting and/or the addition of microbial innoculant, may accelerate the fermentation process and help reach stability earlier**.** The objectives of this study were to evaluate wilting and additive utilization effects on the fermentation process of Tyfton 85 (*Cynodon dactylon spp*.) silage production.

Material and Methods

Harvesting plots were set into a hay field established in 1996 with Tyfton 85 (*Cynodon dactylon spp*.) After each mowing, 358 kg/ha of 30-00-20 (N-P_2O_5-K_2O) was applied, while soil corrective fertilization was aimed at 30 ppm of P_2O_5, V % = 75% and K levels to 5% of CEC. Herbage mass was harvested at the 35th day of vegetative growth. Mowing was performed with a Case harvester (model 8850 HP) equipped with a crusher (metal conditioning twisted rolls). The material was then wilted up to the desired (treatment) dry matter. At the appropriate DM content the forage was chopped (7cm) and baled (Claas, model Quadrant 1200 RC). The bales were immediately wrapped (Reckord, model Q-pack 120) with 6 layers of a plastic film (Trioplast AB) with a 50% overlap.

Estimated dry mater availability prior to harvesting was of 4600 kg/ha and post-harvest residual dry matter was 1600 kg/ha. Treatments consisted of increased dry matter levels of the forage associated or not with the bacterial-enzymatic additive. Five levels (20-30%, 30-40%, 40-50%, 50-60% e 60 a 70%) of dry matter material were baled with no additive. Three other treatments were the low, medium and high (20-30%, 40-50% and 60-70%, respectively) levels of dry matter with addition of a bacterial enzymatic product (Sil-All- Althec Inc.) The silage additive contained 10 x 10^9 UFC of *Streptococcus faecium*/g; 10 x 10^9 CFU of *Lactobacillus plantarum*/g; 10 x 10^8 CFU of *Pediococcus acidilactici*/g and hemicellulase, cellulase and amylase enzymes. Two and a half liters of a 0.5% solution of the additive were used per ton of forage. The additive was sprayed using a system mounted on the bailing equipment. One additional treatment consisted of bales containing 60-70% DM externally sprayed with 0.011mL of buffered propionic acid (Alfa-save - Altech Inc.) per surface square cm.

Temperature and pH measurements were taken from 3 bales per treatment. Temperature was determined with a mercury thermometer at 20-cm depth. From each bale 8 sub-samples were taken and composited to obtain a representative sample at 0, 6, 12 hours and 1, 2, 4, 8, 16, 32 days after bailing when pH was determined. The pH was measured in the solution obtained after 450 ml of deionized water was added to 25 g of the sample..

All data was analyzed in a complete randomized design as repeated measures using the Proc Mixed Procedure of SAS (1988).

Results and Discussion

Temporal trends for silages pH and temperature are shown on tables 1 and 2, respectively. As shown in table 1, final pH tended to increase with DM levels. Intermediate DM silages containing additives resulted in faster pH drop. Intermediary DM levels may combine optimal conditions to pH drop. The presence of microbial additives determined a 8 % and 4% lower final to initial pH ratio, for treatments containing 45 and 65% DM, respectively. At 65% DM silages, pH was not affected by addition of buffered propionic acid solution. Average pH data demonstrated a trend to pH increase up 12 hours after wrapping which probably resulted from higher proteases activities leading to an ammonia surge prior to acid load produced during silage fermentation.

Temperature peaks were reached 24 h after wrapping, and tended to rise with increases in forage DM content, probably due to bale residual aeration. Up to 32 days after wrapping, microbial additives were effective on temperature control compared to silages containing no additives, mainly at 45 and 65% DM, resulting in lower final: initial temperature ratio. Microbial additives promoted a faster decrease on initial temperature and were more effective than buffered propionic acid solution on preventing silage heating, at 65% DM content, which is not in agreement with the literature.

Final silage pH profile and temperature peaks were mainly determined by DM content and presence of microbial additives. Results suggests that a better silage fermentation profile might be achieved either by wilting or the addition of a bacterial-enzymatic additive.

Field DM losses (281 to 177 kg/ha) were increased with higher forage DM. Bale weight (364 kg to 254 kg) and bulk density (310 to 216 kg/m^3) decreased with increased forage DM.

Field and fermentation data suggest an enhanced conservation process at intermediary DM levels.

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Table 1 - Effects of forage dry matter and bacteria-enzymatic additive on silage pH temporal trend .

DM (%)	Time after baling*									
	0 h	6 h	12 h	1 d	2 d	4 d	8 d	16 d	32 d	Mean
					PH					
					Without additive					
25	6,16b[1]	6,39	6,14b	5.98c	5,89c	5,69c	5,56d	5,46d	5,22def	5,83d
35	6,31ab	6,45	6,42a	6,36ab	6,40abc	6,10c	5,66d	5,54cd	5,19ef	6,00c
45	6,43 a	6,44	6,47a	6,46a	6,47a	6,40a	6,12bc	5,76bc	5,48c	6,22b
55	6,36ab	6,46	6,54a	6,48a	6,40ab	6,42a	6,00c	5,76bc	5,44cd	6,20b
65	6,45a	6,47	6,39a	6,43a	6,45ab	6,39a	6,28ab	6,32a	6,26a	6,38a
					pH					
					With additive					
25	6,12b	6,41	6,37ab	6,18bc	6,23abc	6,03c	5,90c	5,81b	5,38cde	6,05c
45	6,49a	6,55	6,52a	6,45a	6,21bc	5,92c	5,62d	5,33d	5,07f	6,02c
65	6,31ab	6,47	6,48a	6,40ab	6,35abc	6,13bc	6,37a	6,13a	5,90b	6,28ab
					pH					
					With buffered propionic acid					
65	6,41a	6,34	6,37ab	6,41ab	6,38abc	6,37ab	6,28ab	6,28a	6,22a	6,34a
Mean	6,33CD[2]	6,44A	6,41AB	6,35BC	6,27D	6,16E	5,98F	5,82G	5,57H	

* h = hours ; d = days
[1]Means followed by same small letters in the column do not differ (P>0,05).
[2]Means followed by same capital letters in the row do not differ (P>0,05).

Table 2 - Effects of dry matter and bacteria-enzymatic additive on silage temperature temporal trend.

DM (%)	Time after baling									
	0 h	6 h	12 h	1 d	2 d	4 d	8 d	16 d	32 d	Mean
					Temperature					
					Without additive					
25	33,99bc	34,00bc	34,00de	37,67b	37,00abc	30,67bcd	31,33ab	27,72	25,33	32,41bc
35	36,67b	32,33c	37,33cd	38,00b	34,00cde	30,00cd	31,33ab	27,67	25,33	32,52bc
45	36,66b	37,35b	36,34cd	40,00b	36,67bc	29,30d	30,66ab	28,00	26,66	33,52b
55	31cd	33,32c	36,33cd	33,00c	32,33de	28,67d	31,33ab	28,67	27,00	31,30c
65	46,67a	46,00a	43,66a	44,66a	40,33a	34,00ab	31,67ab	29,00	26,00	38,00a
					Temperature					
					With additive					
25	27,67d[1]	33,16c	38,66bc	32,01c	32,00e	27,67d	29,00b	28,00	26,00	30,46c
45	33,67b	29,00d	31,67ef	33,00c	34,67bcd	34,67a	33,00a	29,33	26,33	31,7c
65	33,68b	33,34bc	30,32f	36,67b	34,67cde	36,00a	29,67ab	28,67	26,33	32,14bc
					Temperature					
					With buffred propionic acid					
65	47,00a	45,66a	42,00ab	44,33a	40,00ab	33,01abc	31,67ab	28,33	26,33	37,59a
Mean	36,33B[2]	36,02B	36,7AB	37,70A	35,74B	31,55C	31,07C	28,38D	26,15C	

[1]Means followed by the same small letters in the column do not differ (P>0,05).
[2]Means followed by the same capital letters in the row do not differ (P>0,05).