Fermentation kinetics of elephantgrass silage with proportions of cotton residue treated with urea

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Introduction Elephantgrass is largely used on small farms being a strategic source of forage in the dry season of the year. In general, it is left to grow freely for just one cut, resulting in low quality of forage, affecting negatively the animal performance. Making silage seems to be the best way to conserve it, cutting three or four times during the rainy season. However, the high moisture content and the low amount of soluble carbohydrates limit the fermentation process. Dry additives have been added in elephantgrass ensiling to improve the pattern of fermentation (Quadros et al., 2003). In this context, the state of Bahia is the second largest producer of cotton in Brazil, releasing a huge amount of residue. The objectives of this work was to evaluate the fermentation kinetics of elephantgrass silage with two proportions (5 and 10% DM) of cotton processing residue (CR), ammoniated or not with urea (0, 4 and 8% DM).

Materials and Methods The experiment was conducted at the Bahia State University – Campus – IX - Barreiras, in the Laboratory of the Animal Production Research Center, in December 2011. We used a completely randomized design with 7 treatments and 3 replicates. The treatments were: EG100 = elephantgrass (control); CR5 = 5% cotton residue; CR10 = 10% cotton residue; CR5 4U = 5% cotton residue treated with 4% urea; CR5 8U = 5% cotton residue treated with 8% urea; CR10 4U = 10% cotton residue treated with 4% urea, and CR10 8U = 10% cotton residue treated with 8% urea. The residue was gotten in a regional cotton industry. The cotton processing residue was treated with 0, 4 and 8% urea (DM basis), and the urea was diluted with water to increase the moisture concentration to 30%. The treatment occurred for 28 days, and then the material was aerated for 72 hours before ensiling. The elephantgrass cv. Purple with 60 days of regrowth (15% DM) was cut and chopped in particle sizes of 2 to 3 cm. After homogenization between the chopped grass and the CR, the forage mass was ensiled in mini silos made with 20 L plastic buckets containing 4 kg of sand in the bottom to capture the effluent. The grass and the residue were mixed according to each treatment and compressed using feet, reaching an average density of 570 kg/m3. After 50 days, the silos were weighted and opened, measuring density, gas and effluent losses by gravimetric evaluation. After that, pH was measured using the methodology described by Silva and Queiroz (2002). Data were analyzed using ASSISTAT to analysis of variance and comparison of means, assuming significant differences among average values when P values were fewer than 5%. The pH of the silage increased significantly compared to the control.

Results and Discussion The pH of the silage increased significantly compared to the control. The use of urea in ammonization caused alkalinisation of the CR and increasing too much the silage pH decreasing the quality of fermentation (Table 1). The ideal pH for good silage starts at 3.8 to 4.2 (McDonald, 1991). According to these authors, grass silage dry matter contents of 20

% are normally accepted as a lower limit to decrease pH close to 4.0 and then preserve ensiled herbage satisfactorily. However, when herbage is too wet, even lowering its pH to 4.0 would not be enough to inhibit clostridia growth.

The addition of 10% ammoniated residue with 8% urea was effective in reducing effluent losses, differing from the other treatments were similar. Nevertheless, gas losses (range 2.16 to 3.31% DM) were higher than those observed for silage elephant pure (1.29% DM), which may be the high protein concentration of the CR, mainly ammoniated before ensiling, which might have favored the production of ammonia-N. Anyway the effluent losses of this work were high, causing damage to the silage fermentation, in addition loosing of important materials such as sugars, proteins, organic acids and minerals.

The results for the density of the material obtained a variation of 626.25 kg/m3 (control) to 504.52 kg/m3 (addition of 10% ammoniated residue with 8% urea). As the CR has lower density than the elephantgrass, that possibly affected reduce also the density of silage, with a variance because the addition of water and ammonization with urea in cotton processing residue.

Table 1 Effluent and gases losses, recovery of dry matter, density and pH of silages with two proportions (5 and 10% of dry matter) of cotton processing residue, ammoniated with urea (0, 4 and 8% of dry matter).

Treatments	Losses by effluent (kg/ton)	Losses by gas (%)	DM recovery (%)	Density (Kg/m^3)	pH
EG100%	58.5 a	1.3 e	87.1 a	626.2 a	3.7 e
CR5%	54.7 a	3.0 abc	70.4 cde	571.4 abc	3.8 de
CR10%	55.8 a	3.3 a	66.8 e	527.7 cd	4.0 d
CR5% U4%	54.2 a	3.1 ab	69.4 de	599.2 ab	5.1 c
CR 5% U8%	54.7 a	2.3 bcd	76.9 bcd	557.4 bcd	5.2 bc
CR10% U4%	53.8 a	2.2 d	78.3 b	592.7 ab	5.5 b
CR 10% U8%	10.0 b	2.3 cd	77.3 bc	504.5 d	7.4 a
CV (%)	8.28	11.21	3.70	3.81	1.97

[a–e]Means within a column with different superscripts differ (P<0.05).

Conclusions The chemical treatment with urea in cotton residue before the ensilage of elephantgrass did not result in improvements in the fermentation of elephant grass silage with increasing pH and low ability to reduce effluent losses and gases. However, the addition of untreated cotton residue without urea provides an increase in DM and desirable levels of pH of the silage.

References

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