Protein fraction in the ensiling of different purpose sorghum cultivars

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Introduction Sorghum culture can be classified into different purpose, which varies according to the proportions of stem, leaves and panicles. Grain sorghum cultivars present a high proportion of grains, reduced height and well-developed panicles, while forage and sweet sorghum cultivars have high dry matter yield, but the latter with a small percentage of panicle. The protein fractionation allows the adequate formulation of diets, which makes it possible to maximize the efficiency of feed use in ruminant nutrition. The protein can be classified in fraction A, which represents the non-protein N (NPN), with rapid degradation in the rumen; fraction B, which comprises the potentially available true protein; and fraction C, represented by the unavailable N in the gastrointestinal tract. Fraction B is subdivided into fractions B1, which is soluble in the rumen and has a high rate of degradation; B2, with intermediate degradation rate; and B3, associated to the cell wall, with slow degradation rate (Licitra et al., 1996). During the ensiling, proteolytic enzymes degrade the protein matrix present in the sorghum grains, which may promote the increase of NPN contents in silages of sorghum cultivars with high grain proportion (Rooney; Pflugfelder, 1986), but there are few studies that evaluate the protein fractions in the silage production of cereals. Thus, the goal was to evaluate the protein fraction in the ensiling of different purpose sorghum cultivars.

Material and Methods Trial was conducted at the Plant Production Department of the Federal Institute of Education, Science and Technology of Rondonia, Colorado do Oeste campus, and chemical analysis were performed at the Laboratory of Animal Nutrition, at Federal University of Mato Grosso, Cuiabá campus. Experimental design was a randomized block with four replications. Treatments consisted of a 6x2 factorial, with six sorghum cultivars of different purpose (BRS 308 and BRS 310, grain sorghum; BR 655 and BRS 610, silage sorghum; BRS 506 and CMSXS 647, sweet sorghum), and two process situations (forage before ensiling and silage). Seeding was done on November 03, 2011, while crop was harvested when plants presented grains at hard dough stage. For forage evaluation, ten plants per plot were collected and chopped before ensiling. After harvesting, forage was chopped into approximately 1 to 2 cm lengths and ensiled. Experimental units consisted of experimental silos, with 2.5 L volume. Silos remained closed for 30 days. At silos opening, silage samples were collected at the geometric centre. For forage and silage, the mass was homogenized and a sample was freeze-dried at -70° C until it reached constant weight. Then samples were ground to pass a 1 mm screen with a Wiley mill. Fractionation of protein was performed in accordance to the Cornell Net Carbohydrate and Protein System (Licitra et al., 1996). Data were subjected to analysis of variance and the means

were compared by the least significant difference (LSD) test, adopting the probability level of 5%, with the SISVAR statistical program, version 5.3.

Results and discussion For all protein fractions, an interaction effect between cultivars x process was observed (Table 1). At the forage before ensiling, sweet sorghum cultivars had higher contents of A fraction and lower B1 + B2, B3 and C fractions, probably due to the lower proportion of panicles presented by these cultivars, since in the sorghum grain a portion of the protein is in the form of a dense protein matrix (Rooney; Pflugfelder, 1986) instead of NPN. This response pattern was not observed for silages, possibly due to proteolysis in the ensiling, which can explain the increase in the content of fraction A and decrease in the contents of the fractions B3 and C for the grain and forage sorghum cultivars. This may also explain the increase in B1 + B2 fraction content in BRS 655 forage sorghum. The increase in B3 fraction during the ensiling of sweet sorghum cultivars is probably a consequence of the increase in the neutral detergent fiber content caused by the dry matter loss, due to the high ethanol production observed in these cultivars.

Table 1 Forage and silage protein fractions (g 100 g^{-1} CP) of different purpose sorghum cultivars.

Process	Cultivars						CV
	Grain		Forage		Sweet		
	BRS 308	BRS 310	BRS 655	BRS 610	BRS 506	CMSXS 647	
				Fraction A			
Forage	30.08bB	9.29cdB	5.48dB	18.83cB	53.29aA	48.08aA	19.77
Silage	40.56abA	34.66bA	23.50cA	45.31aA	47.84aA	49.98aA	
				Fraction B1 + B2			
Forage	44.44bcA	59.81aA	45.54bcB	51.16abA	34.40dA	38.68cdA	14.29
Silage	49.33bcA	53.20abA	60.85aA	42.97cdA	38.71dA	38.84dA	
				Fraction B3			
Forage	11.17bA	13.81abA	16.67aA	11.87bA	1.93cB	1.58cB	7.47
Silage	4.81aB	6.00aB	4.05aB	4.86aB	8.06aA	4.86aA	
				Fraction C			
Forage	7.16dA	12.37bA	16.16aA	9.07cA	5.19eA	5.83deA	14.75
Silage	5.30bB	6.14bB	11.60aB	6.85bB	5.38bA	6.32bA	

CV: Coefficient of variation. Means followed by the same capital letter in the column and by small letters in the row do not differ among themselves by LSD test ($p > 0.05$).

Conclusion The ensiling process affects the protein fractionation, mainly in sorghum cultivars with a high proportion of grains.

References

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