Bromatological and chemical composition during the silage fermentation of moist grape residue

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Introduction The production of the wine industry is growing in Brazil, generating large amounts of waste. Use of this product in animal feed could come to assist in environmentally friendly destination of waste. However, studies are needed to evaluate the addition of this material in animal feed. Despite the seasonality in the availability of this by-product, silage could increase the supply of food in periods of scarcity, and reduce the costs of animal production. The purpose of this study was to evaluate the efficiency of silage fermentation of moist grape residue (MGR) through the bromatological and chemical composition on different days of opening.

Materials and Methods For this study, 36 polyethylene buckets (4 liters) were used as experimental. The MGR was placed, compacted and then the silos were closed and sealed. Two samples were collected from *in natura* material to represent the time zero, the remaining silos were opened in the following days: 1, 3, 6, 9, 12, 24, 36, 48, 62, 75, 88 and 96. The samples were subjected to pH, dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), neutral detergent fiber (NDF), acid detergent fiber (ADF), acid detergent lignin (ADL) and in vitro dry matter digestibility (IVDMD) analysis according to procedures recommended by Mizubuti et al. (2009). It was used a completely randomized design with three replications. The results were submitted to ANOVA and Tukey test at 5% probability.

Results and Discussion The statistical analysis showed no difference ($P > 0.05$) for the parameters: DM, OM, NDF, ADF and ADL, across different opening days. The DM value of the in natura material was 33.73%, which is within the recommended range for making silage. The average OM content found in MRG silage was 98.06%. Rotava (2007) found the value of 97.4% of OM, working with moist grape marc. The cell wall constituents: NDF, ADF and ADL, showed average values of 67.51%, 56.55% and 41.68%, respectively. Those values can be explained by the high content of seeds (61% in DM). The average CP of silage was 12.20%, with significant differences only between the days 1 and 62 (Table 1). However, Larwence et al. (1984) said that this protein has low digestibility, and that together with the levels of cell wall components and the condensed tannins, impairs the digestibility of this by-product. In this work we observed an average of 51.98% for IVDMD, possibly indicating that the constituents, except for lignin and tannins, have a high digestibility. Dantas et al. (2008) found the value of 46.02% working with dehydrated residue of grapes. The average EE content of the silage was 7.91%. In the literature values range from 5.63% (Dantas et al., 2008) to 16.20% (Rotava, 2007). Wastes from the grape are very variable due to, among other factors, managements and climates in which they were grown and to the harvesting point, which explains some of those variations in the constituents. Regarding some differences in the pH, the values for the silages remained within a range of 4.21 (day 1) to 4.57 (day 96), and the value of *in natura* material was 4.63. In general, values below 4.2 are considered ideal for pH. However, Jobim et al. (2007) argued that this variable should be used with discretion, as unconventional materials can have pH values above 4.2. Woolford (1984) showed that inhibition of secondary fermentation depend mainly on the speed of pH drop, ion concentration and humidity of the environment. Given the values of day zero and day one, it is possible that a very rapid decrease in pH had ocurred, early in the fermentation period.

Conclusion The process of ensiling was efficient in preserving the material, preventing losses in the bromatological and chemical composition of silages studied. MGR silage showed characteristics that enable its use for animal feed.

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Table 1. Bromatological and chemical composition of silage of moist grape residue on different days of opening

Days of Opening	DM, %	OM	CP	EE	NDF	ADF	ADL	IVDMD	pH
		% of DM							
0	33.73	97.97	11.61[ab]	7.64[abc]	68.82	57.25	41.41	52.38[abc]	4.63[c]
1	33.71	98.01	11.13[b]	7.38[abc]	70.11	57.89	43.51	50.88[abc]	4.21[a]
3	33.23	97.97	11.66[ab]	6.98[abc]	65.74	55.39	42.05	52.16[abc]	4.43[bc]
6	33.25	97.92	11.58[ab]	7.94[abc]	70.08	56.72	42.27	50.63[abc]	4.42[bc]
9	33.24	98.06	11.91[ab]	6.57[b]	64.93	59.57	41.70	48.10[c]	4.32[ab]
12	33.45	97.99	12.03[ab]	6.06[c]	66.81	56.36	41.90	50.51[abc]	4.41[bc]
24	33.12	98.01	12.70[ab]	7.18[abc]	66.59	54.99	40.22	51.42[abc]	4.45[bc]
36	32.40	97.92	12.35[ab]	7.45[abc]	68.94	56.34	40.40	50.38[bc]	4.44[bc]
48	35.02	97.78	12.30[ab]	9.57[a]	66.89	54.60	39.22	55.40[a]	4.54[c]
62	33.99	98.04	13.16[a]	9.08[ab]	67.93	56.58	42.75	54.40[ab]	4.51[bc]
75	34.40	97.90	12.42[ab]	9.14[ab]	68.23	56.86	42.03	52.29[abc]	4.54[c]
88	32.45	97.80	12.60[ab]	8.15[abc]	69.52	57.45	41.25	53.57[ab]	4.52[bc]
96	34.57	97.75	12.55[ab]	9.38[a]	64.32	55.83	42.86	54.16[ab]	4.57[c]

[a-c] means within a column with different superscripts differ ($P < 0.05$)