Chemical composition and *in vitro* digestibility of corn silages produced in different stages of maturity

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Introduction Silage is a common method of preserving forage and is based on the conversion of carbohydrates into organic acids (mainly lactic acid) by the action of lactic acid bacteria under anaerobic conditions. As a result, the pH decreases and the forage are preserved against deterioration caused by microorganisms (McDonald et al., 1991). According to Filya (2004), the stage of maturity when the plant is harvested can be considered the main determinant of the nutritional value of silage. Thus, our objective was to evaluate the influence of maturity stage of corn plants on chemical composition and *in vitro* digestibility of corn silages.

Material and Methods A corn hybrid BM3061 was harvested in five maturity stages: without milk line (WML), 1/3 of milk line (ML), 1/2 ML, 2/3 ML and black layer (BL), corresponding to 261.3; 290.9; 321.1; 340.2 and 385.8 g of dry matter (DM)/kg fresh matter (FM). When established the ideal harvest (although observing reduction of the milk line in the grain), all plants of the sub-plot corresponding to the stage of maturity for silage were harvested and cut in particles close to 2.0 cm. As experimental silos were used PVC tubes (4 L; specific mass between 540-605 kg FM/m^3). After 55 days of ensiling, the silos were opened and samples were taken for characterization of silages. The DM, ash, organic matter (OM), total nitrogen (TN) and ether extract (EE) were determined following the recommendations of AOAC (1996). The crude protein (CP) content was obtained by the product between the TN and the factor 6.25. Contents of neutral detergent fiber (aNDF) and acid detergent fiber (ADF) were measured using the techniques described by Van Soest et al. (1991). Lignin content was determined after solubilization the cellulose in 72% sulfuric acid (Van Soest and Robertson, 1985). Total carbohydrates (TC) were calculated according to Sniffen et al. (1992). In assessing the *in vitro* digestibility of OM conducted a test *in vitro* gas production for 72 hours following the procedures described by Mauricio et al. (1999). From the test *in vitro* gas production, the *in vitro* organic matter digestibility (IVDOM) was calculated according to the following equation: IVDOM (g/g of OM) = 14.88 + (0.889 * PG24h) + (0.045 * CP) + (0.065 * MM); where: PG24h = gas production obtained after 24 hours of incubation, CP, and MM expressed in g/kg DM. Experiment was conducted in a completely randomized design. The test of *in vitro* gas production was conducted as split plot, where the factor of plots was the treatments, and the factor attributed to the sub-plots was the time, with four replicates. Data were subjected to ANOVA using the software SISVAR® and the treatment means were compared by Tukey test at 5% significance level.

Results and Discussion The OM contents were changed by stage of maturity; however, there was not standardization among the data. As for the CP content, silage produced with plants harvested in 1/2 ML stood out for having the highest value, although it was not significantly different stages of 1/3 ML and BL (Table 1).

The levels of CHO were changed by the maturity stage, noting only difference between stages 1/2 ML and 2/3 ML. These results are due more to the fact that variable to be calculated using the discount of CP, EE and MM, as there was no difference in the NDF. Overall, it was observed that with the advancement of the maturity stage, the coefficients of IVDOM decreased (Table 1). Plants harvested in less advanced phenological stages have higher sugar content, which have a high digestibility; however, with the advance of maturity, the more soluble compounds are translocated to the stem of the plant, in order to assist in sustaining the same, diminishing digestibility coefficients (Moore and Jung, 2001).

Table 1 Chemical composition (g/kg of DM) and *in vitro* digestibility (g/g of OM) of corn silages produced at different stages of maturity.

Item*	WML	1/3 ML	1/2 ML	2/3 ML	BL	CV (%)	P value
Ash	43.6^{ab}	39.2^{ab}	44.0^{ab}	37.2^{b}	45.3^{a}	7.94	0.0150
OM	956.3^{ab}	960.7^{ab}	955.9^{ab}	962.7^{a}	954.6^{b}	0.35	0.0150
CP	55.5^{b}	61.6^{ab}	69.7^{a}	52.9^{b}	59.2^{ab}	10.41	0.0160
EE	28.6	33.9	29.9	29.0	29.0	16.09	0.5250
CHO	872.2^{ab}	865.1^{ab}	856.2^{b}	880.8^{a}	866.3^{ab}	1.05	0.0221
aNDF	526.5	559.0	556.1	532.3	546.7	4.02	0.1989
ADF	288.9	274.8	314.4	280.9	315.1	7.71	0.0670
Lignin	52.7	47.7	59.2	53.9	47.8	13.8	0.1890
IVDOM	0.584^{ab}	0.631^{a}	0.562^{b}	0.532^{bc}	0.491^{c}	4.57	<0.001

*Means followed by different letters differ by Tukey test (P<0.05). WML = without milk line; BL = black layer.

Conclusions There is no marked change in the chemical composition of corn silages because of the maturity stages. Corn silages produced from high moisture plants show higher coefficients of *in vitro* organic matter digestibility.

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