Nutritive value prediction of maize hybrids for silage production

C. Picinini[1], L. Custódio[1], S.F. Paziani[2], J.L.P. Daniel[1], E.H. Cabezas-Garcia[1], L.G. Nussio[1]
[1]*University of São Paulo, Department of Animal Sciences, Piracicaba, São Paulo, Brazil*
[2]*Pólo APTA Centro Norte, Pindorama/SP*
Email: carol_picinini13@hotmail.com

Introduction Maize crop has a high production of digestible dry matter per hectare and has traditionally been regarded as standard forage for silage production (McDonald, 1991). However, its nutritive value depends on the interactions between genotype, environmental factors and management practices. Thus, both chemical (e.g. NDF %) and agronomic (e.g. plant height) variables should be considered in cultivar selection programs. Therefore, the study of the relations between plant characteristics would provide better target selection, favoring productivity and quality characteristics of most interest (Gomes et al., 2004). The objective of this study was to establish which variable would have greater importance in predicting: a) *in vitro* organic matter digestibility (IVOMD) and b) digestible dry matter production (DDMP) using stepwise regression. The best equations were selected based on the criterion of simplicity (no more than three independent variables), coefficient of determination (R^2) and root mean square residue (RMSR).

Materials and Methods A database from the Evaluation Program of Maize Silage Cultivars for Silage Production of IAC-APTA, obtained during 2010/2011 harvest, was used in this trial. There were evaluated 15 cultivars (12 conventional and 3 transgenic) in four experiments in the state of São Paulo (cities: Votuporanga, Mococa, Andradina, and Tatuí). Beside these, 10 cultivars (five transgenic cultivars and their conventional pairs) were tested in Pindorama city. The plots were distributed in a randomized block design with four replications. Each experimental unit consisted of six lines of 5 meters each spaced 80 or 90 cm. The side lines were considered edge, and the four central lines of 5 meters were the working lines, where the assessments were done. Two lines were harvested at the silage point (DM ~ 35%) and two lines were harvested at the grain maturity stage. After counting plants total number, 10 were harvested, weighed and fractionated to determine the fractions: stem+tassel, leaves and ear. Later, the grains were removed and weighed. Samples of grounded whole plant were dried in a forced air oven at 60°C and ground in a Wiley mill with 1 mm sieve. The chemical composition was determined by reflectance infrared spectroscopy proximal (NIRS) as described by Mello et al. (2006). The associations between chemical and agronomic variables for the cultivars, aiming to predict the nutritive value was established through stepwise multiple regressions using the REG procedure of SAS.

Results and Discussion The prediction equations of nutritive value based on agronomic and chemical variables selection are presented in Table 1. In general, the models for DDMP had better adjustment in relation to the IVOMD variable evidenced by the higher R^2 and lower RMSR values. As expected, as a new variable was included in the stepwise regression, the model adjusted better to the observed data. The DDMP is directly related to the dry matter production (DMP), being the only agronomic variable considered of major importance in these models (R^2 = 0.94, RMSR = 2.63), with the other variables considered in the chemical regressions. This result confirms the previously described by Paziani et al. (2009), in a simple correlation (Pearson) study where it was evident that the dry matter production is one of the main factors that determine the production of digestible dry matter in corn plants (r = 0.85). The NDF was crucial in predicting IVOMD. However, it was not as significant (R^2 = 0.54, RMSR = 2.43) as the DMP in the

equations for DDMP. The nitrogen linked to NDF (N-NFD) was useful to determination of IVOMD (R^2 = 0.64, RMSR = 2.17).

Conclusion Variables associated with the fiber fraction of forage, NDF and N-NDF are important in determining the nutritional value in corn plants for silage production.

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Table 1. Stepwise regressions of chemical and agronomic variables to predict digestibility and digestible dry matter production in corn plants

Variables	Regression model	R^2	RMSR†
1	IVOMD = 88.77 - 0.51 (NDF)	0.54	2.43
2	IVOMD = 85.33 - 1.07 (N-NDF) - 0.30 (NDF)	0.64	2.17
3	IVOMD = 79.60 + 0.78 (CP) - 1.13 (N-NDF) - 0.29 (NDF)	0.66	2.10
1	DDMP = 751.81 + 0.58 (DMP)	0.94	2.63
2	DDMP = 6923.99 + 0.58 (DMP) - 115.77 (NDF)	0.97	1.82
3	DDMP = 6031.90 + 0.59 (DMP) - 197.29 (N-NDF) - 78.93 (NDF)	0.97	1.72

† Root mean square residue; IVOMD: *in vitro* organic matter digestibility; DDMP: digestible dry matter production, NDF: neutral detergent fiber; N-NDF: nitrogen linked to NDF, CP: crude protein, DMP: dry matter production.