Maturity interacts with length of storage to affect ruminal disappearance of starch in mechanically unprocessed corn silage

J. L. Bueno[1], D. C. Bolson[1], F. A. Jacovaci[1], A. L. M. Gomes[1], C. C. Jobim[1] and J. L. P. Daniel[1]
[1]State University of Maringá, Maringá, Brazil, 87020-900, Email: jlpdaniel@uem.br

Keywords ensiling, fermentation, flint endosperm, prolamin, pull-type harvester

Introduction Harvesting corn plants with higher DM content usually increases DM yield and starch concentration, while decreases starch digestibility. Hence, DM digestibility at ensiling is determined by the dynamics of previous phenomena. Additionally, storing corn silage for long periods typically increase starch and CP digestibility, with minor effects on NDF digestibility (NDFD). Thus, the aim of this study was to determine the effects of maturity and length of storage on the ruminal disappearance of starch, CP and NDF in flint corn silage, harvested with a pull-type machine without a kernel processing device. We hypothesized that more mature plants fermented for long periods would achieve the extent of ruminal disappearance of starch of early-harvest plants.

Materials and methods Corn plants with flint endosperm (hybrid 2B877PW, Dow Agrosciences) were mechanically harvested with a pull-type forage harvester without a kernel processor (single row, JF 192 C12) at 1/2 or 2/3 of milk line (ML) growth stages. In each stage, chopped forage was ensiled in mini-bags (500 g per silo, four replicates) and stored for 0, 7, 14, 30, 60, 90, 120 and 180 d. After each storage period, silage samples were frozen at -20°C. Afterwards, samples were thawing, placed (40 g as fed) in nylon macro-bags (15 × 40 cm) and incubated in the rumen ventral sac of a cannulated cow for 24 h, to determine the ruminal disappearance (DEG24). Residues were analyzed for NDF, CP and starch to calculate the ruminal disappearance of those fractions. Data were analyzed as repeated measuring using the Mixed procedure of SAS.

Results and discussion As expected, forage harvested at 2/3 ML had higher ($P < 0.01$) DM content (40%) than at 1/2 ML (30%). On the other hand, early-harvested plants had higher ruminal disappearance of starch, CP and NDF (Figures 1, 2 and 3). Length of storage had minimal influence on NDFD, but increased ruminal disappearance of CP up to 30 d of storage. Differences of ruminal disappearance of starch were large in unfermented forage but smaller in silages fermented for long periods. Nonetheless, contrary to our hypothesis, more mature plants did not achieved the start digestibility of early-harvested plants within 180 d of fermentation.

Conclusion The NDFD was minimally affected by the length of storage, but lower in more mature plants. Ruminal disappearance of starch and CP were higher in early-harvested plants and increased with the fermentation progress. However, corn plants with flint endosperm, harvested at 2/3 milk line with a pull-type machine without a kernel processing device did not achieve the start digestibility of 1/2 milk line plants, even if fermented for 180 d.

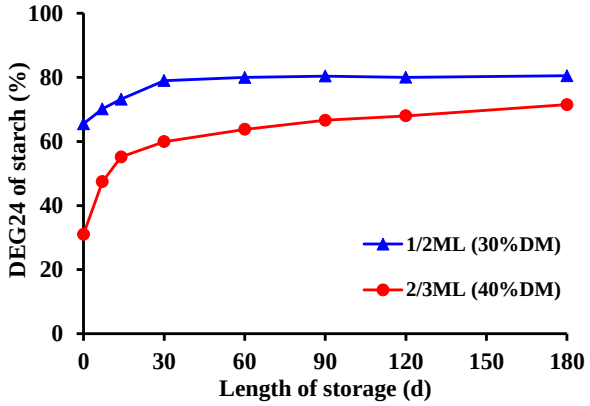

Figure 1 Influence of maturity and length of storage on ruminal disappearance of starch (DEG24 of starch) in flint corn plants harvested with a pull-type machine without a kernel processor device. SEM = 0.80, $P < 0.01$ for maturity effect, $P < 0.01$ for length of storage effect, $P < 0.01$ for interaction effect.

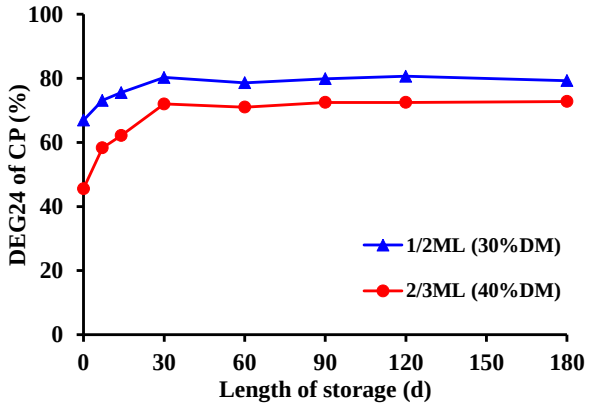

Figure 2 Influence of maturity and length of storage on ruminal disappearance of protein (DEG24 of CP) in flint corn plants harvested with a pull-type machine without a kernel processor device. SEM = 0.81, $P < 0.01$ for maturity effect, $P < 0.01$ for length of storage effect, $P < 0.01$ for interaction effect.

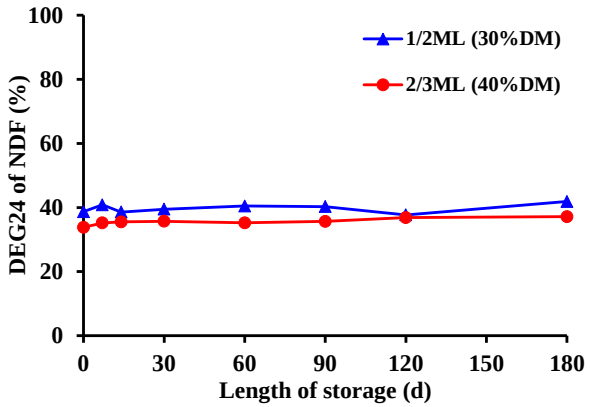

Figure 3 Influence of maturity and length of storage on ruminal disappearance of NDF (DEG24 of NDF) in flint corn plants harvested with a pull-type machine without a kernel processor device. SEM = 0.88, $P < 0.01$ for maturity effect, $P = 0.05$ for length of storage effect, $P = 0.13$ for interaction effect.