Effect of length of storage on the nutrient composition and ruminal *in situ* starch degradability of reconstituted corn grain silage treated with chemical additive

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Introduction The majority of the corn grain grown in Brazil has hard endosperm, high vitreousness and low starch digestibility. The rehydration and ensilage of corn grain allows the breakdown of the protein matrix that surrounds the starch granule in the endosperm, increasing the ruminal and total tract starch digestibility. The use of chemical additives is can be applied to increase the aerobic stability of corn grain silage. The combination of a liquid surfactant can help the moisture penetrate on grain. Therefore, the hypothesis of study was that reconstituted corn grain silage treated with Mycoflake™, that contains propionic acid and a liquid surfactant, polysorbate, would increase the ruminal in situ starch degradability, for allowing the grain to absorb moisture faster and start the process of breaking down of the protein matrix, which surrounds the starch granule, by fermentation in the silo. The objective of this experiment was evaluated the effect of treatment with propionic acid, polysorbate or propionic acid and polysorbate on reconstituted corn grain silage stored for 15, 30 or 60 days on ruminal *in situ* starch and dry matter degradability and soluble protein.

Materials and Methods The experiment was conducted at the Department of Animal Science of the "Luiz de Queiroz" College of Agriculture/University of São Paulo, São Paulo - Brazil. An unknown corn hybrid was ground before ensiling (5-mm screen) and used to make the reconstituted silage. Dry ground corn was mixed with distilled water to achieve a moisture content of 35% and, ensiled in 5-L plastic buckets fitted with sealing plastic cover. The rehydrated corn grain was split into 4 piles (51.7 kg per pile) per treatment, each pile was treated with the following: (1) water (CON); (2) polysorbate 80 (POL) (2 L/t) (Tween™ 80); (3) propionic acid (PRO) (2 L/t) and (4) Mycoflake™ (MYC) (2 L/t) (Kemin América do Sul, Indaiatuba, SP, Brazil). The effect of length of storage (0, 15, 30 and 60 d) was also evaluated, and combined in a factorial arrangement with the effect of additives. Four replicates were used per treatment. Soluble protein (% of CP) was estimated according to Krishnamoorthy (1982). To determine the ruminal *in situ* starch and dry matter degradability, 6 g of dried sample were placed in nylon bags (10 cm x 20 cm) with 50 ± 10 µm of porosity (model R1020, Ankon, Macedon, NY). Bags were incubated in 2 rumen-cannulated Holstein dairy cows fed a total mix ration (TMR). Two replicate from each silo were incubated in each cow for 12 h. Data were analyzed using the MIXED procedure of SAS.

Results and discussion The ruminal *in situ* starch degradability was increased by 9.15%, 15.1% and 20.5% in silages stored for 15, 30 and 60 d respectively, compared with silages stored for 0 d ($P > 0.1$) and silage treated with propionic acid presented lower degradability than the silages treated with Mycoflake and control (CON = 77.1; POL = 75.2; PRO = 73.8; and MYC = 76.8). Ruminal *in situ* dry matter degradability was increased over time ($P < 0.01$) and silage treated with Mycoflake tended ($P = 0.07$) to increase ruminal *in situ* dry matter degradability. Soluble protein increased by 36.5% in silage stored for 15 d compared with silage storage 0 d and at 15 d of storage, silages treated with propionic acid and polysorbate were lower than silage without additive and treated with Mycoflake. There was

interaction between storage length and additive ($P < 0.01$) on soluble protein content. The protein matrix is a physiochemical barrier, which binds starch granules together (Owens et al., 1986). The increase of soluble protein can explain part of increase of ruminal *in situ* starch and dry matter degradability, as result of the breakdown of the protein matrix.

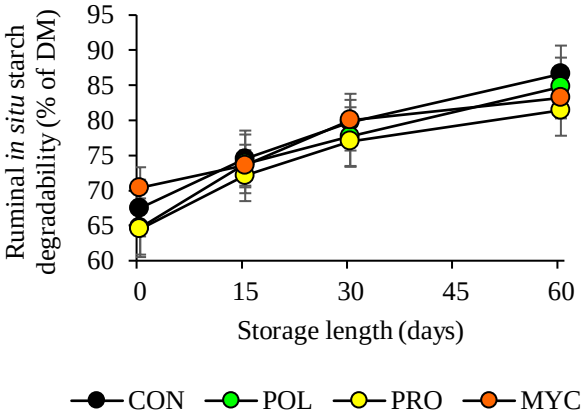

Figure 1. Effect additive (A), $P < 0.01$; effect storage length (S), $P < 0.01$; and interaction between additive and storage length (A x S), $P = 0.35$; SEM = 1.67.

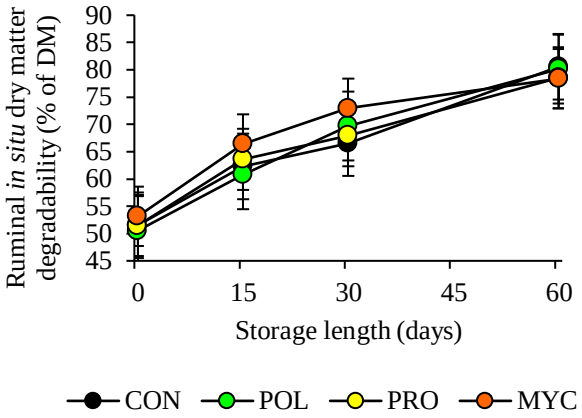

Figure 2. Effect additive (A), $P = 0.07$; effect storage length (S), $P < 0.01$; and interaction between additive and storage length (A x S), $P = 0.21$; SEM = 1.82.

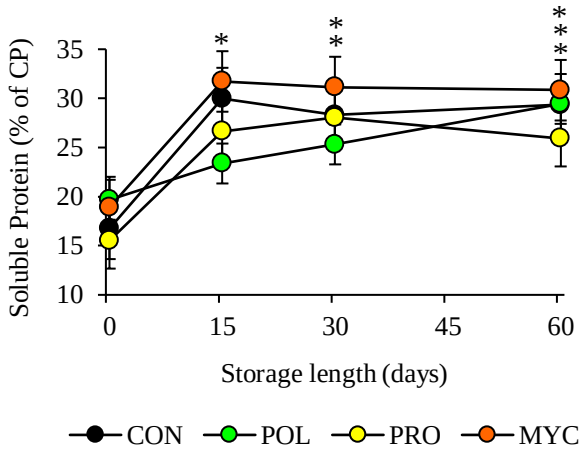

Figure 3. Effect additive (A), $P < 0.01$; effect storage length (S), $P < 0.01$; and interaction between additive and storage length (A x S), $P < 0.01$; SEM = 1.00.

Conclusions Increasing storage length of reconstituted corn grain silage from 0 to 60 d increased starch degradability and soluble protein content. Mycoflake can increased the availability of nutrients. Further studies are needed to better determine the effect of a combination of chemical additive and liquid surfactant.

References

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