Effects of maize cultivar and dry matter content at harvest on rumen fermentation properties

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Introduction

Forage maize is mainly composed of starch in the ears and cell walls in the stover. Upon feeding maize to cattle, starch can be fermented in the rumen, but after bypassing the rumen it can also be digested in the intestines. There is not much knowledge on the influence of maturation of the maize plants on the amount of rumen fermentable starch and on the kinetics of the rumen degradable part. There is also not much insight in the variation in rumen fermentation properties by different genotypes (cultivars). In many feed evaluation systems the total cell wall degradability of maize is valued and not its rate of degradation in the rumen. To get insight in the changes in cell wall and starch quality, 4 different maize cultivars were harvested during the growing season and analysed for chemical composition and rumen fermentation kinetics, determined with the gas production technique.

Materials and methods

Four maize cultivars were harvested at dry matter (dm) contents of 250 (dm250), 320 (dm320) and 390 g/kg (dm390). Cultivar 1 (cv1) was an early dry down cultivar, cv2 early stay green, cv3 late dry down and cv4 was a late stay green cultivar. Plants were separated in ears and stover, freeze dried and ground to pass a 1 mm screen. Samples of 0.5 g dm were incubated in the gas production technique as described by Cone et al (1996). Non-lactating donor animals received 9 kg DM grass hay and 1 kg DM concentrate daily. Gas production profiles were run in duplicate and fitted to a three-phaseic model as described by Groot et al (1996). Presented are values for gas production after 20 h (GP20) and for A1 and A2, gas production caused by fermentation of the soluble and insoluble fraction respectively and B2 the time (h) needed to reach half of A2. Starch degradation after 10 h was calculated using gas production and starch content as described by Chai et al (2004). Statistical differences were recognised using analysis of variance.

Results

Table 1, showing the main effects of the research, displays starch content, starch degradation after 10 h incubation and gas production parameters for the ear and stover samples. Dry matter content at harvest showed significant effects on all parameters. Cultivar was not significant for starch content and B2 in ears. Effects for dry matter x cultivar were only observed in ears for GP20, A1, A2 and degraded starch.

Conclusions

Early harvest results in low starch contents and decreased fermentation of the non-soluble fraction (A2). Upon maturation (higher dm content) rate of degradation of both starch and cell wall decreased (higher B2). This lead to a decrease in percentage starch degradation after 10 h incubation, which indicates a higher percentage of rumen escape starch. Prolonged maturation results in decreased cell wall degradability (low A2) and decreased rate of degradation (high B2). Expanded studies should point the optimum harvest date (dm content) to obtain maize with high yield, high starch content and high cell wall degradability and optimal starch degradation in the rumen with desired amounts of rumen escape starch and maximum digestibility in the intestine.

References