

Effect of EM on the Consumption, Nutritive Value and Digestibility of Corn Silage by Ruminant Animals

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Abstract

Two experiments were conducted to determine the effect of EM on the consumption, nutritive value and digestibility of corn forage (*Zea mays* L.) processed into corn silage after harvesting at two growth stages. Stage 1 silage contained 25 percent dry matter and stage 2 silage, harvested nine days later, contained 37 percent dry matter. The first experiment involved feeding trials with sheep and showed no difference in consumption and digestibility between the untreated and EM-treated stage 1 silage. However, the stage 2 silage treated with EM resulted in significantly higher levels of digestibility of dry matter (DM), crude protein (CP), nitrogen-free extract (NFE), and total digestible nutrients (TDN) than the untreated silage. There was no difference in consumption due to EM treatment. The second experiment involved fistulated steers to assess the potential ruminal degradation of DM and neutral detergent fiber (NDF) in both silages, either untreated or treated with EM. There were no significant differences in potential degradability between the untreated silages; however, the values obtained for the EM-treated stage 2 silage tended to be lower than the EM-treated stage 1 silage.

Introduction

Ensilage is a highly acceptable means of preserving the quality of green fodder such as corn forage (*Zea mays* L.) for feeding ruminant animals during off-season periods. Recent studies have shown that the application of certain microbial inoculants during ensilage can enhance the fermentation process thereby improving silage quality as evidenced by increased consumption, digestibility and animal performance (Mayne, 1990; Smith et al., 1993). Nevertheless, results on the use of microbial inoculants in silage production are often conflicting which is likely attributed to variables such as the types and numbers of microorganisms in the inoculant; nature of the fodder or substrate; nutrient content and availability; indigenous microflora; and environmental conditions within the bio-mass (El Hag et al., 1982).

Bughardi et al. (1980) and Wittenburg et al. (1983) found no significant differences in ruminant consumption and digestibility between untreated and microbially-inoculated corn silage. However, Luther (1985) reported that the treatment of corn silage with a microbial inoculant increased the digestibility of both DM and CP. Cleale et al. (1990) also found that the digestibility of DM and acid detergent fiber (ADF) in corn silage was increased by the addition of a microbial inoculant.

The purpose of this study was to evaluate the effect of EM on the consumption, nutritive value, apparent digestibility, and *in situ* degradability of two corn silages with different dry matter levels.

Materials and Methods

Corn forage was harvested at two stages of maturation (9-day interval) and processed into stage 1 and stage 2 silages with DM contents of 25 and 37 percent, respectively. The harvested forage was divided into predetermined weighed portions, moisturized with water only, or water containing EM diluted 1:100 (8 liters of water and 80 ml of EM) and placed in experimental silos consisting of 100-liter capacity plastic bags. The silos remained sealed for 76 and 67 days for stage 1 and stage 2 silage, respectively.

Experiment 1: Apparent Digestibility *In Vivo*.

This experiment was conducted to determine the effect of EM on the consumption and apparent digestibility of the two corn silages by sheep in individual pens. Four treatments were utilized in the feeding trial: stage 1 silage + EM; stage 1 silage alone; stage 2 silage + EM; and stage 2 silage alone. A proper nitrogen balance was maintained according to the recommendation of the Agricultural Research Council (ARC, 1980, 1984) by adding urea to the ration at feeding time.

After a dietary adaptation period of 14 days, urine and feces were collected for 10 days and samples prepared for analysis. A 2 x 2 factorial design was used to evaluate the effect of EM and corn silage maturation stage on consumption and digestibility.

Experiment 2: Degradability *In Situ*.

The *in situ* degradability of the two corn silages and effect of EM were evaluated with three fistulated steers maintained in individual pens. After a dietary adaptation period of 15 days, nylon bags containing the treated or untreated silages were placed in the fistulas and incubated for 6, 24 and 96 hours prior to removal for analysis (Sampaio, 1988). Degradability was assessed by changes in the level of DM and NDF.

Results and Discussion

The effect of EM on the mean apparent digestibility of two corn silages with different DM contents is shown in Table 1. The DM of stage 2 silage had a higher digestibility when treated with EM than without. However, EM had no such effect on the stage 1 silage. The digestibility of DM for stage 1 silage (no EM) was also significantly higher than stage 2 silage (no EM). There was no difference in DM digestibility when the two silages were treated with EM. These results are similar to those of Luther (1985) who reported increased digestibility of a stage 2 corn silage from inoculation with *Lactobacillus plantarum*. Our results are also in agreement with others (Bughardi et al., 1980; Ely et al., 1982; El Hag et al., 1982; Wittenburg et al., 1983; Cleale et al., 1990) who concluded that microbial inoculants did not significantly enhance the digestibility of stage 1 type corn silage.

Table 1. Effect of EM on the Mean Apparent Digestibility of Two Corn Silages, Processed at Different Maturation Stages, in Feeding Trials with Sheep.

Nutrients	Apparent digestibility (kg/kg)			
	Stage 1 silage		Stage 2 silage	
	EM	No EM	EM	No EM
Dry matter	0.5964a	0.5825a	0.6127a	0.5462b
Crude protein	0.6947a	0.6795a	0.6883a	0.6285b
Crude fiber	0.5784a	0.5858a	0.4990b	0.5236b
Ether extract	0.8363a	0.8233a	0.8538a	0.8272a
Nitrogen-free extract	0.6250a	0.6148a	0.6654b	0.5841a
Neutral detergent fiber	0.5324a	0.5327a	0.4973b	0.4748b
Gross energy (MJ / MJ)	0.6237a	0.6064a	0.6721b	0.5694c
TDN (%)	68.28a	65.34a	65.31a	59.69b

Stage 1 and stage 2 silage contained 25 and 37 percent dry matter, respectively. Nutrient means on a particular line having common letters are not significantly different at the 1% level of probability.

The digestibility of CP for the stage 2 silage was significantly higher due to the EM treatment compared with no EM. However, there was no difference in CP digestibility when EM was applied to stage 1 silage compared with no EM. The digestibility of crude fiber (CF) was significantly higher for the stage 1 silage compared with the stage 2 silage regardless of EM treatment which did not affect the digestibility for either silage. The effect of treatments on the digestibility of neutral detergent fiber (NDF) were similar to those reported for CP, There were no significant effects of maturation stage or EM on the digestibility of the ether extract. However, maturation stage did have a significant effect on the digestibility of the NFE where EM applied to stage 2 silage enhanced its digestibility compared with all other treatments. Interestingly, EM had no such effect on the stage 1 silage. In this regard, Ely et al. (1982) reported that inoculation of silage with *Lactobacillus acidophilus* and *Candida* sp. did not significantly increase the digestibility NFE.

In terms of gross energy (GE), EM treatment of stage 2 silage resulted in a significantly higher digestibility compared with no EM. However, there was little effect of EM on this parameter from treatment of stage 1 silage. The total digestible nutrients (TDN) increased significantly overall when

stage 2 silage was treated with EM. While the TDN was higher for EM-treated stage 1 silage compared with no EM, the difference was not statistically significant.

The *in situ* study on degradability indicated that there was no significant differences (using DM and NDF as indicators of degradation) between the untreated (no EM) silages, stage 1 or stage 2. However, with EM treatment the degradability values tended to be lower for the stage 2 silage compared with stage 1.

Conclusions

Inoculation of the corn silages with EM enhanced the apparent digestibility of dry matter, crude protein, nitrogen free extract, gross energy and total digestible nutrients of the stage 2 silage having a DM content of 37 percent compared with stage 1 silage having only 25 percent DM. Neither the compost maturation stage nor EM affected the animal's consumption rate. There was little effect of EM inoculation on the nutritive value of stage 1 silage compared with untreated (no EM) stage 1 silage. Additional studies are needed to determine whether EM can significantly enhance the nutritive value of silages that may require a longer cultural cycle for fermentation and maturation.

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