# Impact of Masters Choice Corn Silage on Nutrient Digestion in Growing Cattle

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### Summary with Implications

*A digestion study was conducted to evaluate Masters Choice corn silage hybrids on nutrient digestibility in growing beef steers. The three hybrids evaluated were a conventional hybrid (CON) commonly grown in Eastern Nebraska which served as the control, Masters Choice hybrid MCT6365 RIB (MC1) that has been selected to improve fiber and starch digestion and Masters Choice hybrid MCT6733 GT3000 (MC2) selected to improve fiber digestion. Treatment diets consisted of 80% of the diet dry matter (DM) of each corn silage hybrid. Steers fed MC1 corn silage had the greatest organic matter (OM), energy digestibility, and digestible energy (DE) content of the diet. Feeding MC2 resulted in the lowest OM, starch, and energy digestibility and dietary DE content. Steer energy digestion (OM, DE) was intermediate to MC1 and MC2 for CON silage. Results indicated that feeding MC1 corn silage at 80% of the diet DM improved digestion and energy availability to the steers, which allowed greater average daily gain and improved feed conversion observed in the corresponding growing trial, while the opposite was true for MC2.*

### Introduction

In many studies, feeding high inclusions of corn silage has been shown to be more economical in growing and finishing cattle, especially when corn price is high, despite poorer gain and conversion. Methods that improve corn silage quality would benefit cattle backgrounders and feedlot operations that feed greater inclusions of silage. Evaluation of corn silage digestibility is normally done using laboratory techniques to predict the performance if fed to cattle, which may or may not predict actual performance when fed to cattle. The objective of this study was to evaluate two Masters Choice (Anna, IL) hybrids that have been selected to improve fiber plus starch digestion (MC1) and fiber digestion (MC2) on nutrient intake and digestion in cattle. These Masters Choice hybrids were compared to a hybrid (Farm Choice, CON) commonly grown in Eastern Nebraska.



### Procedure

Three hybrids of corn silage were grown, harvested and stored as described in the performance study (*2020 Nebraska Beef Cattle Report*, pp. 24–26). Six ruminally cannulated beef steers (crossbred, 12-month-old) were utilized in a 3×6 Latin rectangle design with three treatments per period. The steers were housed in individual concrete slatted pens with *ad libitum* access to feed and water. Steers were assigned randomly to the same three dietary treatments as described in the performance study (*2020 Nebraska Beef Cattle Report*, pp. 24–26): 80% of diet dry matter (DM) of CON (Farm Choice, served as control), MC1 (selected to improve fiber and starch digestion, Masters Choice MCT6365 RIB; Anna, IL) and MC2 (selected to improve fiber digestion, Masters Choice MCT6733 GT3000; Anna, IL) corn silage in each diet, and the rest included 15% modified distillers grains plus solubles (MDGS), 5% supplement. Supplement was formulated to provide 200 mg rumensin/steer daily (assuming a dry matter intake (DMI) of 22 lb) and 0.5% DM of urea. The study consisted of six periods, 21d in length with 14 days of adaptation and 7 days of collection. Diets were mixed twice weekly and stored in a cooler to ensure freshness. Steers were fed once daily at 0700 h, and feed refusals were removed and weighed daily prior to feeding. Refusals were collected on day 16 to day 19, dried in 140 °F forced-air oven for 48 hours to correct DM intake. Samples of individual ingredients were taken prior to diet mixing during collection week, composited by period, lyophilized, and ground through a 1-mm screen using a Wiley mill.

Steers were dosed twice daily, on day 8 to day 20, intraruminally with titanium dioxide (16 g/day) to determine fecal output. Fecal grab samples were taken at 0700, 1100, 1500, and 1900 h and composited on wet basis daily on day 17 to day 20. The lyophilized and ground (1 mm) daily composites were then composited on a dry weight basis by steer within each collection period. Fecal samples were analyzed for titanium dioxide concentration and used to determine total fecal output. Feed and fecal samples were analyzed for gross energy content (calories/g) using a bomb calorimeter. Digestible energy (DE) was calculated by subtracting the fecal energy from the total gross energy intake. Nutrients such as dry matter (DM), organic matter (OM), neutral detergent fiber (NDF), acid detergent fiber (ADF), and starch content of fecal and feed samples were also analyzed and calculated for total tract digestibility.

Ruminal pH was recorded every minute using wireless pH probes submerged into the rumen, from day 16 to 20. Ruminal fluid samples were collected using a vacuum hand pump, on day 19 of each period at 0730, 1130, 1530, and 1930 h for volatile fatty acids (VFA) analysis. Ruminal VFA samples were analyzed by gas chromatography. Each corn silage (lyophilized and ground through 2 mm) and dry bran (1.25 g) sample were weighed into 5 × 10 cm in-situ bags. In-situ bags (4 per sample) were submerged into the rumen for 28 hours on day 20 at 1100 h of each period. In-situ NDF disappearance was determined, and NDF analyzed using the Ankom Fiber Analyzer.

Apparent total tract digestibility of the nutrients, total nutrient intake, and in-situ NDF disappearance were analyzed using the PROC MIXED procedure of SAS 9.4 (SAS Institute, Inc., Cary, NC, USA), with

**Table 1. Dietary nutrient intake and total tract digestibility for steers fed Masters Choice corn silage hybrids compared to a conventional hybrid as a control**

| | Treatments[1] | | | | |
|---|---|---|---|---|---|
| Item[2] | CON | MC1 | MC2 | SEM | *P*-Value |
| DM | | | | | |
| Intake, lb | 18.1 | 17.7 | 18.1 | 0.64 | 0.88 |
| Digestibility, % | 68.0 | 68.8 | 66.7 | 1.01 | 0.24 |
| OM | | | | | |
| Intake, lb | 16.7 | 16.0 | 16.7 | 0.61 | 0.68 |
| Digestibility, % | 71.2[ab] | 73.1[a] | 69.4[b] | 1.18 | 0.02 |
| NDF | | | | | |
| Intake, lb | 6.8 | 6.7 | 7.3 | 0.26 | 0.25 |
| Digestibility, % | 48.4 | 51.5 | 50.6 | 2.04 | 0.45 |
| ADF | | | | | |
| Intake, lb | 4.1 | 4.2 | 4.2 | 0.18 | 0.89 |
| Digestibility, % | 42.1 | 46.5 | 45.3 | 2.26 | 0.34 |
| Starch | | | | | |
| Intake, lb | 5.8 | 5.7 | 5.5 | 0.22 | 0.64 |
| Digestibility, % | 97.9[a] | 97.3[a] | 96.5[b] | 0.42 | < 0.01 |
| Energy | | | | | |
| Digestibility, % | 69.2[b] | 71.3[a] | 67.5[b] | 0.94 | 0.02 |
| DE, Mcal/day | 24.44 | 24.28 | 23.82 | 0.97 | 0.89 |
| DE Mcal/lb | 1.35[ab] | 1.37[a] | 1.32[b] | 0.02 | 0.07 |
| Bran in situ NDF digestibility, %[3] | 51.6[a] | 45.1[b] | 47.4[ab] | 3.99 | < 0.01 |

[a-c] Means in a row with different superscripts are different ($P < 0.10$)

[1] Treatment include CON, conventional corn hybrid of Farm Choice silage serves as control; MC1, corn hybrid of MCT6365 RIB silage, selected for greater fiber + starch digestion; MC2, corn hybrid of MCT6733 GT3000 silage, selected for greater fiber digestion

[2] DM: Dry matter; OM: Organic matter; NDF: Neutral detergent fiber; ADF: Acid detergent fiber; DE: Digestible energy

[3] Incubated in rumen for 28 hours inside cattle fed treatment diets

period and treatment as fixed effect. Rumen VFA data were analyzed using PROC MIXED with treatment, period, hour and treatment by hour interaction included in the model, steer served as random effect. The pH data were by day (average, minimum, maximum, etc) and analyzed using the PROC MIXED procedure with treatment, period, day and day by treatment interaction included in the model and day being considered a repeated measure.

## Results

Corn silage hybrid did not impact DM intake ($P = 0.88$; Table 1), which differed from the performance study where steers fed MC2 had the greatest DM intake (*2020 Nebraska Beef Cattle Report*, pp. 24–26). Total tract DM digestibility was not impacted ($P = 0.24$) by treatment although it was numerically greater for MC1, and numerically least for MC2. Treatment had no effect on OM intake ($P = 0.68$), but did impact OM digestibility ($P = 0.02$), with steers fed MC1 having the greatest OM digestibility, steers fed MC2 having the least, and CON fed steers being intermediate. There was no treatment effect observed for NDF and ADF intake of steers fed different hybrids of corn silage ($P \geq 0.25$). Although a numerical increase in NDF and ADF digestibility was observed for both MC1 and MC2 fed steers, a significant difference was not detected ($P \geq 0.34$).

Starch intake was not different across silage hybrid treatments ($P = 0.64$; Table 1). Total tract starch digestibility was impacted by dietary treatment ($P < 0.01$), with the steers fed MC2 having the least starch digestibility, and no difference between CON and MC1 ($P = 0.12$). Energy digestibility ($P = 0.02$) as a percentage and dietary DE content ($P = 0.07$) were significantly different among treatments. Steer fed MC1 had the greatest energy digestibility and dietary DE content, followed by CON, and least for MC2. There was no treatment effect for DE intake of steers fed different hybrids of corn silage ($P = 0.89$). There was no treatment × sample effect ($P = 0.98$) for in-situ NDF digestibility; therefore, treatment effect on corn bran in situ NDF digestibility was reported here and there was a significant effect ($P < 0.01$). Surprisingly, steers fed MC1 had the lowest in situ NDF digestibility suggesting something impacted ruminal digestion of fiber in those cattle, with no difference between CON and MC2. The in situ data observation is not consistent with observed total tract digestion of fiber.

There was no silage hybrid treatment effect ($P \geq 0.55$; Table 2) on average, minimum, and maximum rumen pH parameters. A rumen pH below 5.6 was rarely observed in this study. There was significant difference for magnitude and variation of ruminal pH due to silage hybrid, but these changes were relatively small. There was no treatment effect for molar concentration of acetate, butyrate and total VFA of ruminal fluid ($P \geq 0.11$; Table 3). A significant effect was detected for propionate concentration ($P = 0.09$), with steers fed CON (16.76 mM) having the greatest propionate concentration, followed by MC2 (15.66 mM) and MC1 (14.93 mM) with no difference between each other. The acetate:propionate ratio was greatest for MC2, followed by MC1, and least for CON ($P = 0.01$).

## Conclusion

Results suggest that feeding Masters Choice corn silage hybrid MCT6365 RIB (MC1) at 80% of the diet DM improved OM digestibility, energy digestibility and dietary DE content, which explained the improved ADG and feed conversion for steers fed MC1 in a performance study (*2020 Nebraska Beef Cattle Report*, pp. 24–26). Feeding MC2 resulted in numerical decreases in DM, OM, and energy digestibility, which aligned with the numerically lowest ADG and poorest feed conversion of steers fed MC2. These metabolism data align closely with the performance data and suggest that corn hybrid selection can impact nutrient digestion.

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**Table 2. Ruminal pH characteristics for steers fed Masters Choice corn silage hybrids compared to a conventional hybrid as a control**

| | Treatments[1] | | | | |
|---|---|---|---|---|---|
| Item[2] | CON | MC1 | MC2 | SEM | *P* - Value |
| Minimum | 6.20 | 6.16 | 6.23 | 0.05 | 0.64 |
| Maximum | 7.11 | 7.06 | 7.02 | 0.06 | 0.55 |
| Average | 6.70 | 6.64 | 6.64 | 0.05 | 0.69 |
| Magnitude | 0.92[a] | 0.90[a] | 0.80[b] | 0.04 | 0.06 |
| Variation | 0.05[a] | 0.04[a] | 0.03[b] | 0.004 | 0.08 |

[a-c] Means in a row with different superscripts are different ($P < 0.10$)

[1] Treatment include CON, conventional corn hybrid of Farm Choice silage serves as control; MC1, corn hybrid of MCT6365 RIB silage, selected for greater fiber + starch digestion; MC2, corn hybrid of MCT6733 GT3000 silage, selected for greater fiber digestion

[2]Average pH over 5 days; Treatment × Day was not significant ($P = 0.31$)

**Table 3. Ruminal VFA concentration for steers fed Masters Choice corn silage hybrids compared to a conventional hybrid as a control**

| | Treatments[1] | | | | |
|---|---|---|---|---|---|
| Item[2] | CON | MC1 | MC2 | SEM | *P* - Value |
| Acetate, %[3] | 64.45 | 65.33 | 66.60 | 1.91 | *0.14* |
| Propionate, %[3] | 21.14[a] | 20.20[b] | 20.08[ab] | 1.28 | *0.09* |
| Butyrate, %[3] | 10.29 | 9.92 | 9.42 | 0.40 | *0.11* |
| Total VFA, mM | 79.28 | 73.88 | 78.01 | 3.54 | *0.17* |
| Acetate:Propionate ratio | 3.31[b] | 3.43[ab] | 3.58[a] | 0.19 | *0.01* |

[a-c] Means in a row with different superscripts are different ($P < 0.10$)

[1] Treatment include CON, conventional corn hybrid of Farm Choice silage serves as control; MC1, corn hybrid of MCT6365 RIB silage, selected for greater fiber + starch digestion; MC2, corn hybrid of MCT6733 GT3000 silage, selected for greater fiber digestion

[2]Average concentration over 4 time points (0730, 1130, 1530, and 1930); hour × Treatment was not significant ($P \geq 0.75$)

[3]Percent of total VFA; difference was compared on molar concentration (mM) basis