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Jana L. Harding
*University of Nebraska-Lincoln*

Adam L. Shreck
*University of Nebraska-Lincoln*

Melissa L. Jolly-Breithaupt Breithaupt
*University of Nebraska-Lincoln*, melissa_jolly_brethaupt@unl.edu

Galen E. Erickson
*University of Nebraska-Lincoln*, gerickson4@unl.edu

James C. MacDonald
*University of Nebraska-Lincoln*, jmacdonald2@unl.edu

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# Using Enspira to Improve Fiber Digestion

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## Summary

*A metabolism study was conducted to evaluate the effects of supplementing a fibrolytic enzyme (Enspira™) on total tract digestion of a finishing diet.* In situ *NDF digestibilities of the corn bran, HMC, corn residue, and corn silage were not different between the treatments. Rate of digestion of the corn residue and corn silage was lower for the enzyme treatment compared to the control. Average ruminal pH was not significantly different between the two treatments. Correspondingly, there was no difference in VFA profile. There were no differences in DM, OM, NDF, ADF, or hemicellulose digestibilities between the control and enzyme treatment.*

## Introduction

About one-third of corn production in the U.S. is used for ethanol production today. The utilization of corn in the production of ethanol, in addition to high and variable corn prices, has forced cattle producers to feed less corn. Non-traditional feeds like corn milling byproducts and low quality forages are being used to replace corn in beef cattle diets. However, these feed alternatives are higher in fiber content compared to the corn being replaced, thus resulting in more fiber-based diets. Therefore, if the digestibility of these fibrous components of cattle diets could be improved, cattle efficiencies could be increased. Enspira is a direct-fed enzyme designed to increase fiber (i.e., hemicellulose and cellulose) digestion. Previous research has shown that treating corn bran, husks, and WDGS with Enspira can improve *in vitro* (tube outside the animal) digestion (*2014 Nebraska Beef Cattle Report*, pp. 59-61). Therefore, the objective of this experiment was to evaluate the impact of dosing Enspira on *in vivo* (inside the animal) digestibilities.

## Procedure

Four ruminally cannulated steers were utilized in a three period switchback design. All steers were fed a basal diet consisting of 40% Sweet Bran®, 45% HMC, 10% corn silage, and 5% supplement (DM basis). Steers were randomly assigned to one of two treatments, with treatments consisting of the basal diet treated with the enzyme or the basal diet without the enzyme treatment (Control). Enspira was added to the total mixed ration at a rate of 0.25 lb/ton of DM for the enzyme treatment. The rate of inclusion was determined by previous *in vitro* work (*2014 Nebraska Beef Cattle Report*, pp. 59-61). In order to ensure accurate incorporation into the diet, the enzyme was prepared as a premix, then incorporated into a dry supplement (added at 5% of diet DM), using fine ground corn as a carrier. Steers were housed in individual slatted floor pens and fed once daily at *ad libitum* intake.

Each period was 21 days in length consisting of a 14 day adaptation and 7 day collection. Titanium dioxide (10 g/day) was dosed intraruminally at 0800 and 1600 hours on days 9 to 21. Fecal grab samples were collected at 0800, 1200, and 1600 hours on days 16 to 20. Samples were then freeze-dried and composited by steer and period. Fecal samples were analyzed for titanium dioxide concentration to estimate DM excretion. Fecal and diet samples were analyzed for DM, OM, NDF, ADF, and hemicellulose to estimate total tract digestibility. Rumen samples were collected at 0800, 1200, and 1600 hours on days 16 to 20 and analyzed for volatile fatty acid (VFA) concentration. Wireless pH loggers (Dascor, Inc., Escondido, Calif.) were placed in the rumen on day 15 and recorded pH measurements every minute until day 21. *In situ* bags were incubated for 0, 6, 12, 16, 24, 48, and 96 hours in each steer starting on day 17. Samples incubated consisted of corn bran, high moisture corn (HMC), corn residue, and corn silage. *In situ* bags were removed from the

**Table 1. Effect of dietary treatment on intake and total tract digestibility.**

| | Treatment | | | |
|---|---|---|---|---|
| Item | Control | Enzyme | SEM | *P*-value |
| DM | | | | |
| Intake, lb/day | 22.33 | 22.19 | 1.52 | 0.89 |
| Total tract digestibility, % | 80.3 | 78.3 | 1.6 | 0.47 |
| OM | | | | |
| Intake, lb/day | 21.04 | 20.91 | 1.43 | 0.91 |
| Total tract digestibility, % | 82.3 | 80.2 | 1.6 | 0.44 |
| NDF | | | | |
| Intake, lb/day | 5.08 | 4.91 | 0.57 | 0.76 |
| Total tract digestibility, % | 63.5 | 55.2 | 4.6 | 0.24 |
| ADF | | | | |
| Intake, lb/day | 1.68 | 1.70 | 0.12 | 0.89 |
| Total tract digestibility, % | 56.3 | 51.2 | 4.7 | 0.52 |
| Hemicellulose | | | | |
| Intake, lb/day | 3.89 | 3.79 | 0.26 | 0.61 |
| Total tract digestibility, % | 70.7 | 63.0 | 5.0 | 0.37 |


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**Table 2. Effect of Enspira on *in situ* NDFD (%) and rate (%/hour).**

| Sample | Treatment | | SEM | *P*-value |
|---|---|---|---|---|
| | Control | Enzyme | | |
| Corn Bran | | | | |
| NDFD, % | 48.75 | 47.75 | 14.37 | 0.56 |
| Rate, %/hour | 6.28 | 5.82 | 0.731 | 0.65 |
| HMC | | | | |
| NDFD, % | 62.06 | 59.41 | 14.37 | 0.10 |
| Rate, %/hour | 3.65 | 3.37 | 0.667 | 0.76 |
| Corn Residue | | | | |
| NDFD, % | 37.12 | 35.73 | 14.37 | 0.40 |
| Rate, %/hour | 3.81 | 1.40 | 0.667 | 0.01 |
| Silage | | | | |
| NDFD, % | 41.36 | 40.16 | 14.37 | 0.46 |
| Rate, %/hour | 4.43 | 1.95 | 0.667 | 0.01 |

**Table 3. Effect of dietary treatment on ruminal pH and volatile fatty acid (VFA) profile.**

| Item | Treatment | | SEM | *P*-value |
|---|---|---|---|---|
| | Control | Enzyme | | |
| Average pH | 5.71 | 5.74 | 0.16 | 0.91 |
| Maximum pH | 6.72 | 6.53 | 0.15 | 0.41 |
| Minimum pH | 4.97 | 5.10 | 0.18 | 0.66 |
| pH magnitude | 1.75 | 1.43 | 0.21 | 0.39 |
| pH variance | 0.151 | 0.129 | 0.017 | 0.41 |
| VFA Profile | | | | |
| Total, mMol | 113.89 | 110.94 | 5.51 | 0.74 |
| Acetate, mMol/100 mMol | 51.87 | 52.19 | 0.82 | 0.81 |
| Proprionate, mMol/100 mMol | 30.65 | 29.05 | 2.73 | 0.60 |
| Butyrate, mMol/100 mMol | 12.28 | 13.18 | 2.28 | 0.73 |
| A:P | 1.78 | 1.88 | 0.18 | 0.61 |

steers on day 21, rinsed with distilled water, and ran through an ANKOM fiber digester to estimate NDF digestibility. The nonlinear function of SAS was used to calculate rate of fiber digestion of the *in situ* bags. When calculating NDF digestibility, a 3%/hour rate of passage was assumed. All data were analyzed using the MIXED procedures of SAS (SAS Institute, Inc., Cary, N.C.). Steer was the experimental unit. Steer and steer*treatment were considered random.

## Results

No differences ($P \geq 0.61$) in intakes were observed between the two treatments (Table 1). Total tract digestibilities of DM, OM, NDF, ADF, and hemicellulose were not different ($P \geq 0.24$) between the control and enzyme treatment. This could be attributed to the competition with the enzymes that are already present in the rumen. It also could be that the enzyme didn't have enough time to attach to the fibrous components of the feed since enzymes are normally excreted after the rumen microorganisms attach to the fibrous components. There was no impact ($P \geq 0.10$) of the enzyme on *in situ* NDF digestibility for the corn bran, HMC, corn residue, or silage (Table 2). Rate of digestion was not improved when incubating the corn bran or HMC ($P \geq 0.65$). However, the rate of digestion for the corn silage and corn residue samples decreased when incubated in steers fed the enzyme ($P \leq 0.01$). There was no difference ($P = 0.91$) in average ruminal pH (Table 3) between the control and enzyme treatment. Correspondingly, there was no difference ($P \geq 0.41$) in maximum and minimum pH recorded. There were no differences ($P \geq 0.60$) between the control and enzyme treatment in total VFA concentration, proportion of acetate, proportion of propionate, or proportion of butyrate. Similarly, the ratio of acetate to propionate was not significantly different ($P \geq 0.60$).

## Implications

In conclusion, the impact of the enzyme is variable. Previous *in vitro* research suggested that including Enspira at 0.25 lb/ton of DM would improve ruminal digestion. However, when ruminally cannulated steers were fed Enspira at a rate of 0.25 lb/ton of DM it had no impact on total tract digestibilities of DM, OM, NDF, ADF, or hemicellulose.

[1]Jana L. Harding, research technician; Adam L. Shreck, research technician; Melissa L. Jolly-Breithaupt, research technician; Galen E. Erickson, professor; Jim C. MacDonald, associate professor, University of Nebraska–Lincoln Department of Animal Science, Lincoln, Neb.

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