

# PSXI-11: Effects of exogenous glucoamylase enzymes or a combination with a neutral protease on total tract apparent digestibility and feces D-lactate in bulls fed a total mixed ration rich in rolled corn

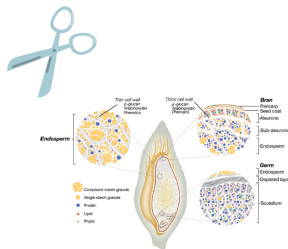
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## Objective

The aim of this study was to evaluate the effect of 2 glucoamylases (GA) and the combination of one GA with a neutral protease on total tract apparent digestibility in bulls fed a total mixed ration (TMR) rich in rolled corn.



Adapted from Grundy et al. (2018)

## Introduction

The present study is one of first studies where glucoamylases (GA) from glycoside hydrolase family 15 (GH15) (EC 3.2.1.3) are tested in cattle:

- ✓ The end-product of these GA enzymes is glucose instead of the mixture of glucose, maltose and maltooligosaccharides which are the end-products produced by  $\alpha$ -amylase (AA) (GH13) (EC 3.2.1.1).
- ✓ Based on the abundance of genes coding for the enzymes in the rumen AA activity is much abundant compared with GA.

In addition, a neutral protease (BamPro from *Bacillus amyloliquefaciens*; stable at rumen pH (from 5.5 to 7) was included as a 3rd treatment and supplemented in combination with AfuGA (AfuGA+BamPro), hypothesizing that the combination would synergistically increase starch digestibility with GA by degrading the protein matrix encasing starch granule in the endosperm.

## Materials and Methods

- Sixteen Angus beef bulls (266  $\pm$  4.9 kg of initial BW, and 182  $\pm$  1.7 d of age) were housed individually in pens and were distributed in 4 blocks of 4 animals balanced by BW.
- The experimental design was a 4 x 4 Latin square (4 blocks and 4 periods) with periods of 2 wks.
- Four treatments were tested:

- 1) **CTR**: control, a blank solution of 0.2% potassium sorbate and 0.6% sodium benzoate corresponding to the preservatives used in the enzyme preparations
- 2) **TrGA**: GA preparation from *Trichoderma reesei*
- 3) **AfuGA**: GA preparation from *Aspergillus fumigatus*
- 4) **AfuGA+BamPro**: a GA from *A. fumigatus* and a *B. amyloliquefaciens* neutral protease preparation.

- These enzyme solutions were daily mixed in a dry TMR with 70% of rolled corn at a rate of 10 mL for 40 kg TMR (70% rolled corn, 15% corn DDG, 10% alfalfa, 2.4% SBM; 3.19 Mcal/kg ME, 16.7% CP in DM).
- From day 8 to 14 chromium oxide (1 mg/kg) was mixed with the diet and from day 12 to 14 feces were collected to estimate total tract apparent digestibility and D-lactate concentration.
- Feed intake was recorded daily.

## Results

Table 1. Daily nutrient intake, nutrient fecal output, and apparent total tract digestibility

	CTR	TrGA	AfuGA	AfuGA+BamPro	SEM	P-value <sup>2</sup>
<b>Intake, kg/d</b>						
DM	7.8	7.9	8.0	7.6	0.12	0.19
OM	7.4	7.5	7.6	7.3	0.12	0.18
Starch	3.7	3.8	3.8	3.7	0.07	0.29
CP	1.3	1.3	1.3	1.2	0.03	0.11
Ether extract	0.49	0.49	0.49	0.46	0.009	0.10
NDF	1.7	1.7	1.7	1.7	0.03	0.33
<b>Apparent total tract digestibility, %</b>						
DM	66.7 <sup>b</sup>	71.1 <sup>a</sup>	74.7 <sup>a</sup>	72.8 <sup>a</sup>	2.01	0.05
OM	66.8 <sup>b</sup>	71.3 <sup>a</sup>	74.9 <sup>a</sup>	72.9 <sup>a</sup>	2.03	0.05
Starch	74.7 <sup>b</sup>	80.2 <sup>a</sup>	84.1 <sup>a</sup>	81.3 <sup>a</sup>	2.25	0.04
CP	67.7	70.8	74.4	72.4	2.14	0.17
Ether extract	61.2	62.5	64.7	62.7	2.87	0.84
NDF	50.0	53.9	58.4	58.1	2.91	0.15

Feces D-lactate concentration did not differ among treatments (values ranged from 0.77 to 1.29 mM)

## Conclusions

In crossbred Angus fed over 70% of rolled corn apparent total tract starch digestibility was significantly increased when supplementing a fungal glucoamylase from *T. reesei* or *A. fumigatus* or a mixture of the *A. fumigatus* glucoamylase and a neutral protease from *B. amyloliquefaciens*