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Beef Science Cluster

Optimizing protein levels in feedlot diets containing DDGS

Project Title:

Nutritional Strategies to Optimize Protein Value of Feeding Ethanol By-Products to Beef Cattle

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Background:

Optimizing protein formulation in the diet of growing beef cattle is one of the most effective and practical methods of improving feed conversion efficiency and growth performance. Many protein feeds are commercially available for cattle, including soybean meal, canola meal and distillers' grains (DG). Canola meal is a common protein feed in western Canada and its production is expected to increase. However, canola meal protein is degraded more readily in the rumen.

DG derived from ethanol plants is used in beef cattle diets depending on its availability and price relative to the cost of cereal grains. Chemical composition and feeding value of DG vary with grain source and milling process. In the U.S., ethanol is produced mainly from corn. In western Canada, ethanol is also produced from wheat. In conventional milling, the entire kernel is subjected to fermentation. In fractionation milling, corn kernels are physically separated into bran (mainly fiber), germ (oil) and endosperm (mainly starch, with some protein and oil), and only the endosperm fraction is fermented. The process used affects the chemical composition of the DG. Fractional DG generally has higher protein, lower fat and lower fiber contents than does conventional DG (lower protein, higher fat, higher fiber). This may also affect the growth performance of cattle.

Objectives:

To determine:

- rumen degradability of protein from DG varying in grain source (corn and wheat) and milling process (traditional vs. fractionation);
- flows of microbial protein, bypass protein and amino acid (AA) supply to the small intestine, and digestibility of bypass protein and AA in the intestine; and
- growth performance and feed efficiency of backgrounded beef cattle.

What They Did:

Four protein feeds (canola meal, wheat DG, corn DG and fractional corn DG) were evaluated in three experiments.

Experiment 1 studied rumen breakdown AA quality of the four proteins. Bags containing the four different protein sources were put into the rumens of three ruminally cannulated beef heifers fed 60% silage and 40% barley. The bags were removed after 0, 2, 4, 6, 12, 16, 24, and 48 hours to compare the extent and rate of protein degradation in the rumen. Lab tests were used to determine the AA composition of the rumen undegradable or “bypass” protein that remained in the bags at the 16 hour mark.

Experiment 2 used five heifers with cannulas in both the rumen and the intestine to study protein digestibility. Each heifer was fed 60% silage and 40% barley grain, plus one of four supplements (canola meal, wheat DG, corn DG, fractional corn DG) providing 14% crude protein, compared to a control diet (no supplement; 12% crude protein). The diets were changed every 21 days so that each diet was fed to each heifer. Feed intake, rumen pH, and intestinal protein and AA digestibility were measured.

Experiment 3 compared how different protein sources affect the growth performance of backgrounded feedlot steers. Two hundred crossbred steers (initial weight 274 kg) were grouped into 20 outdoor pens (n = 10 steers/pen). The twenty pens were allotted randomly to the same five diets fed in the second experiment. Feed intake, body weight, daily gain, and feed efficiency were measured during a 120-day feeding period.

What They Learned:

Experiment 1: Bypass protein from conventional corn DG and wheat DG provide similar amounts of absorbable total AA to the intestine, but corn DG provides more absorbable essential AA than wheat DG. Fractional corn is a good source of bypass protein, but it is less digestible than protein from conventional corn DG and wheat DG.

Experiment 2: Increasing the protein level from 12% (control) to 14% (canola meal, wheat DG, corn DG or fractional corn DG) in barley-based backgrounding diets increased intake by 12%, and nutrient flow into the intestine by 14%. This indicates that several protein ingredients can be used effectively in the diets fed to backgrounded cattle to provide more nutrients to animals. Supplementing wheat DG and fractional corn DG in backgrounding diets delivered greater amount of protein and AA at the small intestine compared to canola meal and corn DG.

Experiment 3: Compared to the 12% protein control diet, the backgrounding diets containing corn DG and fractional corn DG improved growth rate by 9% and feed efficiency by 8%. Canola meal improved growth rate by 13% and feed efficiency by 6%, and wheat improved growth rate by 5% and feed efficiency by 2%.

What it means:

Protein supplement feeds increase feed intake, rumen microbial protein production and nutrient flow to the small intestine. This increases protein and carbohydrate availability to growing cattle and improves the growth performance of backgrounded steers.

The chemical composition, rumen degradability of protein, AA profiles and intestinal absorption vary among different protein supplements. This affects the growth performance of backgrounded cattle. Not all protein supplements are the same. Differences in nutrient composition, potential impacts on animal performance, availability and price all need to be considered when selecting protein supplements for feeder cattle.

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