



# RESEARCH FACTS

RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY



## Effects of feeding ethanol byproducts on rumen health

Project Title:

Evaluation of Distillers' Grains from Ethanol Plants for Feedlot Cattle

Researchers:

**Wenzhu Yang** [yangw@agr.gc.ca](mailto:yangw@agr.gc.ca)

Tim McAllister, Karen Beauchemin, M.L. He (AAFC Lethbridge) and John McKinnon (University of Saskatchewan)

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### Background

Rumen microbes convert dietary starch and fiber into volatile fatty acids, which cattle absorb and use as an energy source. On high grain diets, rapid volatile fatty acid production from starch causes rumen pH to drop (become more acidic). Grain overload (acute acidosis) can occur when cattle that are not adequately adapted to a high energy diet consume too much grain, too quickly. So much lactic acid is produced that the rumen stops functioning properly, and the animal temporarily goes off feed. Acidosis may cause rumen ulcers that allow bacteria to enter the bloodstream, infect the liver, and cause visible liver abscesses at slaughter. Other problems (e.g. founder) can also occur. Rumen bacteria produce less lactic acid in cattle that are properly adapted to a high grain diet, but they can still produce enough volatile fatty acids to cause sub-acute ruminal acidosis. Keeping a small amount of silage in the finishing diet helps provide the neutral detergent fiber (NDF) necessary to maintain a healthy microbial population and stimulate rumen function. Dried distillers' grains with solubles (DDGS) contain very little starch and much more NDF than grain. However, maintaining rumen health on high grain diets requires adequate NDF particle size as well as adequate NDF levels. The NDF particles need to be large enough to be physically effective in slowing digestion and stimulating rumen contractions. This is referred to as peNDF. Although DDGS have relatively high NDF, they may have low peNDF. This means that DDGS fiber may be digested relatively easily by rumen microbes, and too small to stimulate rumen contractions.

### Objective

To examine whether using wheat DDGS to replace barley grain and silage in finishing diets affects rumen function, animal performance, carcass quality, and liver abscesses.

## What they did

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The control diet contained 85% barley-based concentrate and 15% barley silage. One experimental diet replaced some of the barley grain with wheat DDGS (65% concentrate, 10% silage, 25% wheat DDGS). The other two experimental diets replaced silage with wheat DDGS. These two diets both contained 65% concentrate, and either 5% silage (30% DDGS) or 0% silage (35% DDGS). Cattle were fed once per day, and the supplement contained Rumensin but not Tylan. In an intensive metabolic experiment, the four diets were fed to eight heifers with rumen cannulas. Two heifers were fed each diet for a three week period. After two weeks of adaptation to the diets, rumen pH was continuously measured for seven days. Then the heifers were rotated to another diet, and this was repeated until all heifers had been fed all four diets. A feedlot experiment fed these four diets to 200 crossbred steers. Animal performance was monitored, and carcass measurements and liver abscess data were collected at the packing plant.

## What they learned

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Replacing barley grain with 25% wheat DDGS reduced diet digestibility but had little effect on rumen pH. In the feedlot trial, replacing grain with DDGS resulted in slightly higher dry matter intakes but no change in growth rate or feed efficiency, carcass weight, dressing percentage, lean meat yield, quality grade, or liver abscess scores.

Replacing barley silage with DDGS led to steady increases in diet digestibility and increased the amount of time that rumen pH was below 5.8 (mild acidosis) or below 5.5 (moderate acidosis). Cattle fed the 10% silage diet spent 3.3 hours per day in mild acidosis, compared to over 5.5 hours for cattle fed 5% or 0% silage. Cattle fed the 10% silage diet spent 1 hour of the day in 'moderate acidosis', compared to over 2 hours for cattle fed 5% or 0% silage. In the feedlot trial, replacing silage with DDGS led to significantly lower feed intake, but no significant changes in growth rate or feed efficiency, carcass weight, dressing percentage, lean yield or quality grade. However, the percentage of abscessed livers rose from 16% (10% silage) to 24% (5% silage) and 50% (no silage).

## What it means

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Replacing barley grain with DDGS exchanged some of the grain starch for very small DDGS fiber particles that rumen microbes could degrade easily. This did not change rumen pH, but it did reduce the energy density of the diet. This meant that cattle ate more to meet their energy needs, with no clear benefit in feedlot performance or carcass value. Replacing silage with DDGS exchanged large fiber particles (peNDF) from the silage for small, easily degraded fiber particles (non-peNDF) from the DDGS. This made the rumen more acidic and reduced feed intake. Feedlot performance and carcass value were not affected, but the incidence of liver abscesses increased. This shows that an increase in the duration of moderate acidosis does not always impair animal growth. In commercial practice, feeding animals more frequently, or adding Tylan to the concentrate may help overcome some of these challenges.

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**For More Information Contact:**

Beef Cattle Research Council  
#180, 6815 - 8th St. NE  
Calgary, AB T2E 7H7  
Tel: (403) 275-8558 Fax: (403) 274-5686  
[info@beefresearch.ca](mailto:info@beefresearch.ca)

**For More Information Visit:**

[www.beefresearch.ca](http://www.beefresearch.ca)

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