

# Research Facts

Research & Technology Development for the Canadian Beef Industry



## Making wheat DDGS work in cattle rations

by Alberta Crop Industry Development Fund

### Project Title:

Use of exogenous enzymes to improve nutritive value of bio-ethanol co-products

### Researchers:

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### Project Code:

2012F012R

### Completed:

September  
2014

### **Background:**

*This ethanol by-product has feed value, but how much of it is suitable for backgrounding and finishing cattle? With support from ACIDF and ALMA, Researcher Wenzhu Yang has answered this question.*

Western Canada is home to 7 wheat/corn-based ethanol plants. These plants produced over 500,000 tonnes of distillers grains annually.

The growth of the bioethanol industry in Western Canada has provided the cattle feeding industry with an abundant source of feed – dried distillers grain with solubles (DDGS) – but also a dilemma. Wheat DDGS, essentially the leftovers after wheat is processed into ethanol, may be plentiful and appear inexpensive, but what is its true value as feed? This question was the subject of a 19-month study conducted by Wenzhu Yang, Ruminant Nutrition Research Scientist with Agriculture and Agri-Food Canada in Lethbridge. Yang's research was funded by the Alberta Crop Industry Development Fund (ACIDF) under the \$8 million Feeding Initiative managed for the Alberta Livestock and Meat Agency (ALMA).

"We compared the performance of the animals, with or without DDGS in the ration, to see whether it can improve animal growth performance," says Yang. "We used wheat DDGS to replace 30% of the barley for finishing, and 15% for backgrounding, on a dry matter basis." Even though wheat DDGS is available for cattle feeding, it's been associated with liver abscesses in cattle. Yang's hypothesis was that adding specialized proteins known as enzymes to the ration could mitigate this effect.

The enzymes, he believed, could help break down the fibre in the wheat DDGS in a way that would unlock its feed value without the liver trouble. Yang selected a handful of enzyme candidates for comparison as part of the study.

## **Objectives:**

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1. Determine key enzyme activities of cellulose, xylanase and protease of collected enzyme candidates obtained from industry collaborators (e.g., AB Vista, UK; Dyadic International Inc., USA; Adisseo, France) and measured under rumen conditions.
2. Determine the optimum rates of each potential enzyme that maximize in vitro DM and NDF digestibility of wheat DDGS and barley silage.
3. Determine growth performance, feed efficiency and feed digestibility in the total digestive tract of beef cattle fed backgrounding or finishing diets supplemented with feed enzyme. The effects of enzyme supplementation on carcass characteristics and fatty acid profiles of muscle samples (skirt muscle of diaphragm) were measured in finishing cattle.

## **What They Did:**

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Study 1 - Characterization of enzyme activity to ensure that only enzyme products with high activity at rumen conditions were used in the evaluation.

Study 2 - In -vitro incubation. A series of in-vitro batches were conducted to screen the best enzyme product to potentially improve DM and fibre digestibility in the rumen.

Study 3 - In-situ and in-vivo digestion. The effects of feed enzyme on ruminal digestibility of wheat DDGS, barley silage and grass hay were assessed using in-situ techniques. The effects of feed enzyme digestibility of wheat DDGS and barley silage, and the total digestibility of finishing diet were measured.

Study 4 - In-vivo background trial. 120 weaned calves were used to evaluate the effects of wheat DDGS inclusion and feed enzyme supplementation on growth performance and feeding behaviour.

Study 5 - Feedlot growth performance. 160 yearling steers were fed to evaluate the effect of adding Econase XT (Ab Vista, UK) to diets on growth performance and carcass traits.

## **What They Learned:**

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There are 3 key findings:

1. Enzymes help digestibility. "When you first add the wheat DDGS, it actually decreases the feed efficiency," says Yang. "You need to add the feed enzyme to increase digestibility." In Yang's study, adding various feed enzymes to rations containing wheat DDGS was found to improve an animal's digestion of dry matter, fibre and protein. The enzyme known as xylanase was associated with the best results.
2. Feedlot: 30% wheat DDGS, with enzyme, pays off. In feedlot cattle, wheat DDGS could replace 30% of barley in a ration. Provided enzymes are added to the ration – 2 mL/kg of dry matter was the proportion used by Yang – the results are significant. This ration improved feed efficiency (defined as daily gain per kg of feed intake) by up to 5%. Under this regime, liver problems were reduced by roughly half. Abscessed livers went from 49% of animals to 25%; severely abscessed livers declined from 33% of animals to 15%. This also improved the fatty acid profile of the meat from these animals, which could in turn deliver an added nutritional benefit for consumers.
3. Backgrounding: go with 15% wheat DDGS. Yang compared the performance of cattle being backgrounded, but believed that a ration with 30% wheat DDGS would be too high for younger animals. He found that, in a barley silage or barley grain-based ration, having 15% wheat DDGS (with enzyme added) was highly beneficial. It boosted fibre digestibility by 14%, average daily gain by 16% and overall feed efficiency by 11%.

## **What It Means:**

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Feedlot and backgrounding operators know that wheat DDGS is often plentiful, can be relatively cheap and is especially attractive when barley prices are strong. Still, many hesitate because of uncertainty about its feed value and its association with liver damage. Yang's work could allow these beef producers to take advantage of wheat DDGS as a feed component, lower their costs compared to an all-barley ration and improve the growth performance of their cattle.

Better performance at lower cost will be music to the ears of Alberta beef producers. By Yang's calculation, greater use of wheat DDGS could be a real difference-maker for the economics of cattle feeding.

"We see a potential gain of \$10 to \$20 per head," says Yang. "If you do this across the Alberta feedlot sector, this could potentially increase profits by \$25 million."

Examples based on September, 2014 feed costs: The cost of feed enzyme at the application rates of 1 L or 2 L/t (MT) of feeds would be 3.5 or 7c/head per day. We have calculated the production profit using a "Performance and Cost of Gain of Calculation program" (Darryl Gibb, beef nutrition consultant, Lethbridge, AB).

Background calves: For beef calves on 90 day feeding, the ratio of the profit to enzyme cost was 6.7 (\$18.4 : 2.8 per head) or 1.8 (\$10.1 : 5.6 per head), respectively, for calves supplemented with 1 L or 2 L enzyme/t feed (DM basis) versus no enzyme fed calves; the ration was formulated with 60% barley silage and 40% barley concentrate mix (DM basis). However, the ratio of the profit to enzyme cost was negative -4.6 or -2.2, respectively, for the dose of 1 L or 2 L enzyme/t feed versus no enzyme fed calves when 15% of barley grain was replaced with equal wheat DDGS.

Feedlot steers: For the finishing beef steers on 110 day feeding period, the ratio of the profit to enzyme cost was 5.8 (\$22.0 : 3.9 per head) or 2.9 (\$21.8 : 7.6 per head), respectively, for steers supplemented with 1 L or 2 L enzyme/t feed (DM basis) versus no enzyme fed steers. The ration was formulated with 10% barley silage, 60% barley concentrate mix and 30% wheat DDGS (DM basis).

The significantly reduced incidence of abscessed livers with feed enzyme use for wheat DDGS diets could potentially reduce antibiotic use in feedlot operations.

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