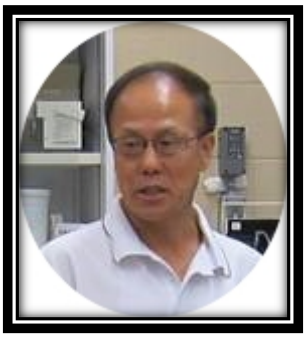
New technique predicts rate of digestion for feedlot cattle

by Kieran Brett

With funding support from ACIDF and ALMA, this researcher found a novel way to predict and thus avoid acidosis, associated with rapid digestion of starch in the rumen.

Alberta's 151 feedlots finish roughly 1.8 million cattle each year. This is the crucial final step in creating the beef industry's $3.2 billion in annual farm cash receipts in this province.

According to Wenzhu Yang, pictured right, one of the industry's biggest production challenges comes from its key feedgrain: barley.



"We tell producers, there's a large variability in barley that's available for commercial sale," says Yang, Lethbridge-based Research Scientist, Ruminant Nutrition with Agriculture and Agri-Food Canada. "It depends on the year, the variety, agronomic practices such as seeding rate, grain processing and more. Feedlots look at feed value based on bushel weight, but that's only one factor in feed value."

The introduction of Near Infrared Spectroscopy (NIRS) technology has been a game-changer in assessing feed value. It provides a rapid estimate of chemical composition for characteristics such as starch, protein and fiber.

This information is a great help, but as Yang explains, feedlot operators need even more. It's not just what's *in* the barley that matters to producers, but how quickly it's digested in the rumen. A fast rate of starch digestion increases the risk of rumen acidosis, which leads to reduced growth performance and feed efficiency as well as costly liver abscesses.

"Feedlots use NIRS to predict composition, but if you want to increase feed efficiency and decrease the risk of acidosis, you have to look at rate of digestion," says Yang. "What they really need is a model or equation to predict digestibility of processed barley."

Over the past three years, Yang developed the predictive tool that feedlot operators have been looking for. This 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).

Research targets in-vitro method

How quickly will barley starch be digested in the rumen? Yang decided to create an in-vitro or lab-based simulation of the digestive process.

First, he needed the barley itself. The project sourced processed barley samples from 10 commercial feedlots over an 18-month period. As expected, these samples varied widely in chemical composition (including starch content) as well as bushel weight.

Next, Yang simulated the digestion process in-vitro, by incubating processed barley samples in a vessel meant to chemically imitate the rumen of a feedlot animal. He observed the rate of digestion of the barley starch at various intervals, such as four hours and six hours. Once again, variability was a significant factor. At four hours of in-vitro incubation, the rate of digestion ranged from just 20% to an acidosis-threatening 70%.

Synthesizing the data, Yang then developed an equation that can predict the rate of barley starch digestion for a given sample. Processing played a significant role in these results. The greater the proportion of small barley particles in the ration, the higher the rate of digestion tended to be.

“We found that particle size is highly relevant to digestibility,” says Yang. “If you just measure the small particles, you see how fast the barley will be digested.”

Compared to five years ago, feedlots operators now have a vastly better toolkit at their disposal to assess feed value. NIRS allows a quick and accurate prediction of chemical composition. Wenzhu Yang’s pioneering work on rate of digestion will allow producers to estimate how quickly barley starch will be digested.

Says Yang: “Producers can process and feed barley so that it modulates starch fermentation in the rumen, to lower the risk of acidosis and improve growth performance.”

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