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PROCESSING DRIVES FEED GRAIN IMPROVEMENT

by KIERAN BRETT

Technologies and additives are bringing progress on several important fronts. Here's a look inside the issues and players involved.

At one time, nothing could have been further from the public's mind than livestock manure. Today, with greater consumer concern about environmental issues, the back end of a cow or a hog is suddenly on the public agenda. Livestock producers are under pressure to reduce the amount of manure from livestock, and while they're at it, reduce the amount of nitrogen and phosphorous it contains.

According to Doug Walkey, Executive Director of the Alberta Crop Industry Development Fund (ACIDF), there are several possible ways to tackle this problem.

"Suppose you're talking about phosphorus, of which there tends to be a lot in livestock manure," says Walkey. "You could use genetics to improve the animal's ability to use phosphorous. That would help, but it would take many years and many millions of dollars. You could also redesign the grain so that it stores less phosphorus, so that less goes into the manure. This could also take many years and many millions of dollars."

Given enough time and money, then, both these options could make a contribution. When time and money are limited, however, feed grains processing technology can play an important role. The addition of a phytate enzyme to grain during processing can make it easier for livestock to use the available phosphorous.

As Walkey explains, the addition of the phytate enzyme creates a win-win. The animal grows more efficiently, which helps the producer, and there's less phosphorous in the manure, which benefits the environment and improves public attitudes about the sustainability of agriculture.

Indeed, the phytate enzyme is just one example of the contribution being made at the processing level.

"This is about solving problems, and to do this, the whole industry needs to work together," says Walkey. "Plant improvement can play a role, so can livestock improvement, but a really crucial piece of the puzzle is feed grains processing."

IT'S ABOUT ENERGY

Pork producers want to improve production while controlling costs. Greater energy digestibility can help.

The way Jim Gowans sees it, Western Canada's pork producers have been in an energy crisis for some time.

It's not the kind of energy crisis where it costs too much to gas-up the truck, or heat and light the barn. The energy that producers need most is inside prairie-grown feed grains and producers want better ways to access it.

"We need improvements in energy digestibility and more energy per acre of grain," says Gowans. "If you're in the pork business these days, it's all about driving down costs and driving up performance. Energy is by far the most expensive nutrient, at over 80% of the diet cost."

For many years, Gowans owned and operated a feed consulting company. Today, he's involved in a pork production management company with 10,000 sows on five farms and a feed mill in Irma, Alta. He also sits on the Advisory Committee of the Western Grains Research Foundation, where he represents the pork producer organizations of Alberta, Saskatchewan and Manitoba.

In this latter role, he tries to help grain researchers understand what's most important to pork producers, and to reflect producers' needs in their work.

"From a production point of view, the sophistication that you see on farms today is impressive," says Gowans. "The issue is cost. If you look at the operating cost of pork production, two-thirds of it relates to feed, whether it's processed on the farm or purchased from a feed mill."

What's the answer? Feed grain varieties with better digestibility (net energy to the pig) would help, as would grain varieties more easily ground during feed processing. Added phytase has made more energy available to pigs at low cost, while reducing phosphorus manure concerns.

Some grains, however, respond to added feed enzymes better than others. If new high-yielding varieties are high in non-starch polysaccharides (which is poorly digested) how well will these varieties respond to supplemental digestive enzymes?

Whether future advances relate to fractionation, enzyme innovation or other areas, Gowans and the country's pork producers have a message: it's time to solve the energy crisis.

More ways to capture nutritional value

Processing plays an important role today. Expect an even bigger role in the future.

The main elements of livestock feeding are subject to change: new grain varieties come along from time to time, new processing technologies are commercialized and innovative feeding regimes are developed.

For John Kennelly, however, the ultimate goal remains constant.

"Feed grains are a major source of nutrients for the livestock industry, and we want to capture as much of these nutrients as possible in the end-product, whether it is meat, milk or eggs," says Kennelly, Dean of the University of Alberta's Faculty of Agricultural, Life & Environmental Sciences. "And of course, we want to minimize the amount coming out the other end of the animal."

As Dean, Kennelly is a keen observer of the mutual impacts that exist between agriculture and society. As a long-time researcher in the nutrition and lactating physiology of the dairy cow, he's also in a position to see how processing and feeding strategies can meet new demands from society.

"Right now, meat production is being hit on many fronts," says Kennelly. "For one thing, there is concern about nitrogen and phosphorus in manure. If we can capture more of the nitrogen in product it will reduce the amount of nitrogen coming out of the animal. So, there are good reasons for doing this in terms of economic efficiency, and there are good reasons in terms of the environment."

Technology brings greater precision

Kennelly explains that conventional practice in formulating rations has traditionally erred on the high side of nutrient values. To be certain that an animal's growth wasn't compromised by a lack of available minerals, rations often contained more minerals than the animal could likely use, just to be on the safe side.

At the processing level, Near InfraRed Spectroscopy is one technology available today to quickly, accurately and cost-effectively measure the nutrient content in the feed. This will allow animal nutritionists to avoid over-shooting the mineral levels the animal can use, which should reduce the mineral content of manure.

"If you are farming 1,000 hogs, you can't wait for a digestibility study to come back from the lab," says Kennelly, "therefore, we need these tools to accurately predict the presence and availability of nutrients."

Processing offers exciting possibilities

The simple act of chopping feed grains makes the feed product better in terms of palatability and nutrition. More recently, the addition of enzymes at the processing level has made more nutrients available at very little cost. Looking down the road, with upward pressure on grain prices, Kennelly believes processing will be asked to do more for farmers and for society.

As one example, he points to the processing and feeding potential of Dried Distillers Grain Solubles, a by-product of ethanol production. Using DDGS derived from a crop like triticale would allow the ethanol industry to avoid societal conflicts from using human food crops for energy production. With the right processing approach, these ethanol leftovers could work beautifully in the feed bunk.

"In my view, we have been quite conservative in the amount of processing we have done," says Kennelly. "When feed grain prices are increasing, there is even greater incentive to extract every possible last amount of nutrition for the animal. We don't have to wait 10 to 20 years for a new grain variety. Processing and additives can play a big role."

PUTTING A VALUE ON FEED

The better we are at measuring what's in feed grains, the more we can use processing to improve it.

Most everyone knows that different grain varieties embody different attributes. But did you know that once grain finds its way to a feed mill, its variability has far more to do with environmental conditions than genetics? That's according to Ruurd Zijlstra, Associate Professor of Agricultural, Food and Nutritional Science at the University of Alberta.

"In fact, it's not even close," says Zijlstra. "About 80% to 90% of the variability relates to the environment and just 10% to 20% is about genetics. The question is, when you have a range in quality, how do you put a value on feed?"

Zijlstra is one of the researchers working hard to crack the quality/value equation for feed grains. A traditional tool -- wet chemistry analysis -- is highly accurate at assessing the feeding value of a sample of grain. It also has two drawbacks: time required and cost involved.

"If we have lots of time available, we have lots of techniques we can use," says Zijlstra. "If we have relatively little time, then it comes down to NIRS and related technologies."

NIRS – which stands for Near InfraRed Spectroscopy -- is a technology that uses light energy to measure the amount of chemical bonds containing hydrogen within a sample. This produces a 'spectral' fingerprint which is unique for each sample. This fingerprint is compared to the chemical composition of a sample to produce a calibration model.

Jim Helm, Alberta Agriculture and Rural Development's Head of Research for Feed Crops, is currently developing calibrations for feed quality. For his part, Zijlstra is developing a reference method to analyze large quantities of feed grains so that calibrations can be developed. He's using an innovative technique that mimics the digestive system of a pig.

Knowledge unlocks options

The point of NIRS is not just to know what's in the feed, but to tell nutritionists how to they can amend it to achieve a desired nutritional end.

They can ferment feedstuffs before they are fed to livestock. They can steep them in water before feeding. They can remove the fiber from the grain mechanically. All these steps can make nutrients more available and can make the feed more palatable, and all begin by knowing the nutritional value of the raw grain.

"We should never underestimate the ability of a pig to deal with different feedstuffs," says Zijlstra. "They are omnivores that will eat anything and everything. We can also allow the pigs to adapt to higher fiber, higher protein and cheaper feed stuffs. We have many options we can use, and more are on the way."

PROCESSING TECHNOLOGY TARGETS ENERGY, PROTEIN VALUE

This animal nutritionist believes emerging technology will allow your local feed mill to deliver even more.

Every bushel of grain that enters the Unifeed Viterra mill in Sherwood Park, Alta. is ground, using a 3-mm screen to produce grain particles between 600 microns and 800 microns in size.

From there, explains animal nutritionist Vince Gabert, the processes Unifeed employs and the amendments it adds depend on the specific nutritional needs of the customer's livestock.

A typical addition is phytate, an enzyme that improves feed grains in at least two ways. First, phytate helps break down the fiber of the grain, which improves digestibility and therefore the resulting energy value of the grain. Second, it reduces phosphorous content.

"Phytate breaks down the naturally occurring phosphate in grains that pigs and chickens can't use," says Gabert. "Furthermore, when you improve conditions in the animal for digestibility, you can also free up the availability of other nutrients such as zinc, copper, calcium and magnesium."

In fact, research shows that phytate enzymes can increase phosphorus uptake in pigs by up to 70%, with a corresponding reduction of phosphorous in the manure.

Emerging technologies include 'designer' enzymes

Enzymes, then, are an important part of daily operations for Gabert, and for other animal nutrition specialists across Canada. If you visit Gabert five years from now, there's a good chance you'll see that his use of innovative processing methods and additives has greatly expanded. He believes the feed industry is in the early stages of what these tools will ultimately contribute.

Today, for example, there are enzymes intended specifically for barley and for wheat. Before too long, animal nutritionists will have many more enzymes to choose from, based not just on the crop being amended but on the specific end-use of the feed.

"You can think of these as 'designer' enzymes," says Gabert. "I see the emergence of enzymes we can use to target specific qualities in the feed. For example, you could have an enzyme that's specifically for DDGS from wheat. DDGS is very high in fiber, and a specialty enzyme will be helpful in breaking down the fiber, to improve nutrient availability for the animal."

New horizons in fractionation, extrusion

Along with designer enzymes, Gabert's vision for the near-future includes more emphasis on fractionation of grains for feed. Take the example of faba beans. By the process of fractionation, the seed coat can be removed, making it easier for the animal to access this high-protein feed ingredient. The same principle can be applied to peas. In other applications, grain can be fractionated into high-protein constituents (intended for hogs) and lower-protein constituents (ideal for cattle).

Today, Gabert's facility uses grinding, pelletizing, steam-conditioning and other methods to improve the digestibility of feed grains. He's betting that extrusion – in which grains are processed using a combination of heat and mechanical pressure – will increasingly be part of his toolbox.

"Extrusion is a good fit for something like canola meal," says Gabert. "We can take canola that is not considered suitable for oil extraction, use extrusion to process it, and wind up with a product that's 21% protein."

Looking ahead, all these emerging tools, additives and processes serve the same aim: providing greater feed value at lower cost to the producer and with less impact on the environment. While feed grains processing is important today, there's much more in store for the future.

Says Gabert: "The whole objective is to get the most efficient combination of feed ingredients. We want to create higher efficiency and reduce the amount of solid waste, and there will be many new ways to do this."

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ACIDF recognizes and thanks the following organizations for their expertise and dedication to improving how processed feed grains meet the needs of buyers and consumers.

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This is the fourth in the series of articles that look in depth at specific solutions to feed competitiveness and will outline investments being made by private industry, farmers, research organizations, government and funding agencies in present and future feed grains research and development. Printed copies are available upon request or visit our website www.acidf.ca for others issues.