Alberta and Shanghai partner to cut pollution

By Nicholas Zeman* |

Canada currently has a stable annual production of approximately 7 million tonnes of canola seed per year, and much of that output is exported (Photos: Canola Council of Canada)

Canola is at the centre of recent efforts between the Alberta Research Council and the Shanghai Academy of Agricultural Science to reduce phosphorous in animal waste by genetically modifying diets. While GMOs continue to meet with resistance around the world, Feed Tech sources say the risks associated with genetic modification are much less troublesome than the dangers of industrial livestock pollution.

Jian Zhang came to Canada from China almost fifteen years ago to study biotechnology at the University of Guelph in Guelph, Ontario. Zhang still lives in Canada, working as a research scientist for the Alberta Research Commission (ARC), and has been instrumental in developing a partnership between his native and adopted countries to reduce phosphorous emissions in livestock waste while adding value to canola seed. The ARC and the Shanghai Academy of Agricultural Science (SAAS) are using genetic technology to buffer the harsh and toxic realities of animal waste production by introducing an enzyme to the canola seed which aids the digestion of the phytate molecule, which contains phosphorous.

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Through the genetic modification of canola, Zhang says feed scientists can add value to canola feed by encouraging the utilisation of phosphates within animals, "stimulating the metabolism of the compound in their own systems, and decreasing the levels of the harmful agent in their waste."

Canola crushing is a major industry in western Canada, and one that the country is looking to expand, as demand for animal feed and cooking oils around the world grows all the time. One way to grow export markets is to offer a superior project. "If the animal can break down phytate in the canola, and it can be utilised nutritionally, then feeders no longer need to add the phytase enzyme as an ingredient," Zhang says. "This increases the value of canola and it decreases the cost of feed."

Improving availability

Similar to other vegetable sources where phosphorous is present as phytate, the amount available for digestion is estimated to be between 30 and 50% of the total phosphorus level, which is what Zhang's research looks to improve. So far during the 2008/09 crop year, which started on August 1, Canada has exported 304,000 tonnes of canola meal and 177,000 tonnes of canola oil, but none has gone to China, says the Cereals and

Oilseed Review for Statistics Canada. Canada, through projects like the CAN$1.4 million (€865,000) genetic modification project between the ARC and SAAS, is looking to expand its market for canola in China. Because China grows a rapeseed variety that is inferior to canola, scientists in Shanghai are looking to increase the country's own canola cultivating expertise by working with Canada, the world's leading producer.

"The value of canola being shipped from Alberta to China increases almost three-fold with the implementation of this technology," says Zhang, once a research associate at both the Chinese Academy of Science in Beijing and the Biotech Division of the department of plant agriculture at the University of Guelph. "That will encourage trade."

Technology, collaboration, reaction

Sage Biosciences, a feed additive technology company located in Edmonton, Alberta, has worked with ARC for several years on various topics and recently became involved with the phytase gene expression project. Lyle Rode, chief science officer for Sage Biosciences says when institutions with special areas of expertise cooperate on solving a problem, the power and knowledge of the effort builds. Certainly, a scientific project to modify animal diets can be very complex.

"The conditions have to be right for the animal to absorb certain nutrients during digestion, so there is a lot more to the success of this project than simply managing the genetic modification on the canola," Rode tells *Feed Tech*. "Sage Biosciences is contributing nutritional advice, while the ARC and those in Shanghai are handling the laboratory tasks of protein expression and gene manipulation."

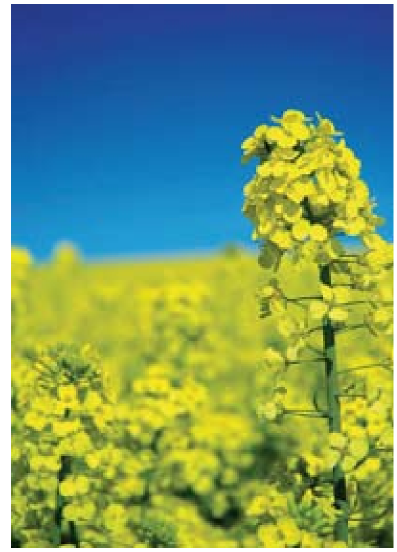
The macro mineral *phosphorous* is an essential nutrient for livestock, health, growth and development. Often, however, it is not readily available for the animal to absorb through digestion. Therefore, producers often need expensive enzyme additives to help the animal break down the phytate molecule of which phosphorous is a part. "The phosphorous is wrapped up in that molecule and it can't be digested," Rode says.

Because there isn't a naturally occurring phytase enzyme in canola, genetic researchers in Alberta and Shanghai are trying to modify genes so that seeds will express the protein needed to metabolise the phytate molecule. "Phytase is a virtually required additive in Europe," Rode says, "because it allows animals to digest phosphorous so that a lesser amount is contained in the waste which can wash into water supplies and cultivation lands."

A type of rapeseed

Canola is one of two cultivars of rapeseed or *Brassica campestris* (*Brassica napus L.* and *B. campestris L.*). Their seeds are used to produce edible oil that is fit for human consumption because it has lower levels of erucic acid than traditional rapeseed oils and to produce livestock feed because it has reduced levels of the toxin glucosin.

Canola was originally naturally bred from rapeseed in Canada by Keith Downey and Baldur R. Stefansson in the early 1970s, but it now has a very different nutritional profile in addition to much less erucic acid. The name "canola" was derived from "**Can**adian **o**il, **l**ow **a**cid" in 1978.

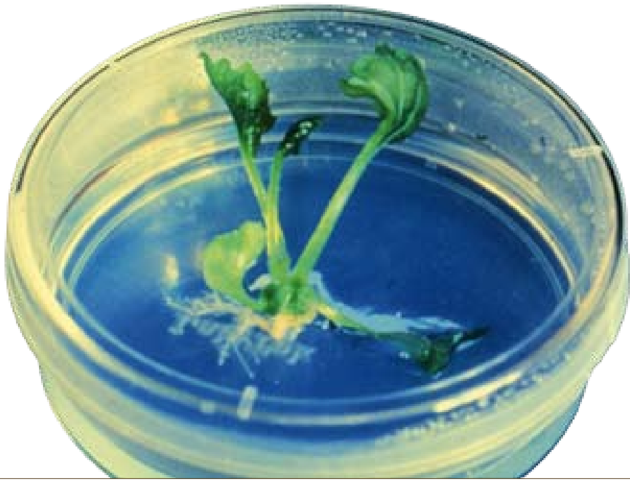


Heat stability

Because canola meal undergoes several vigorous processing operations before it appears in feed bins, the phytase enzyme must be able to withstand the pressure it receives in field-to-feedlot scenarios, and still function by the time it gets to the animals. For instance, temperatures associated with the pelleting process have caused the enzyme to become inactive and thus useless for increasing digestibility. "Our project has access to a very heat stable enzyme which the agronomists are trying to get that seed to express," Rode says. "That is one of the tricks though—to ensure that enzyme is not only expressed but that it survives various processes."

Rode, who studied animal science at the University of Saskatchewan in Saskatoon and later dairy science and microbiology at the University of Wisconsin in Madison, Wis., says there will be several benefits of this research for many different areas relating to industry and the environment. "Canola farmers will have a variety they can grow that will have an added value over other feeds, because it has more nutrients and protein available for the animal," Rode says. "Also, livestock producers will reduce their feeding costs because they can lower their volumes…the advantage for the general public is reduced phosphorous pollution."

Even though genetic manipulation scientists are often involved with work to reduce the footprint of industrial farming they manipulate naturally occurring plants. There is a anxiety over the unknown and a "Frankenstein-like" fear in regard to mainstream acceptance of GMO crops. "The consumer would love to believe that there is zero risk in the food supply chain," Rode says.



Canola does not have a naturally occurring phytase enzyme. Genetic researchers in Alberta and Shanghai are trying to modify genes so that seeds will express the protein needed to metabolise the phytate molecule

"But that just isn't possible."

Fears such as the proliferation of uncontrollable species, the rise of antibiotic-resistant bacteria and others fuel a steady resistance to GMO crops. The perceived—or potential—risk involved with the genetic manipulation of feed staples, however, is still much less than the dangers of phosphorous pollution, Rode says. "The public never sees this as relative-risk, or a risk/reward type of scenario," he says. "The dangers of pollution outweigh the small risks associated with gene transfer." |

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