

Gene-Altered "Enviropig" to Reduce Dead Zones?

Pigs modified to excrete less phosphorus win limited approval in Canada.

3 MINUTE READ

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Move over, bacon. Here comes something greener.

A genetically engineered pig recently approved for limited production in Canada makes urine and feces that contain up to 65 percent less phosphorous, officials have announced.

That could be good news for lakes, rivers, and ocean deltas, where phosphorous from animal waste can play a role in causing algal blooms. These outbursts of algae rapidly deplete the water's oxygen, creating vast dead zones for fish and other aquatic life. (Related: ["World's Largest Dead Zone Suffocating Sea."](#))

Dubbed Enviropig, the genetically altered animal cleared a major hurdle last month, when the government-run [Environment Canada](#) approved the animal for production in controlled research settings.

The new biotech pig could take years to pass U.S. and Canadian tests for commercial use and human consumption, noted Steven Liss, an environmental scientist at the [University of Guelph](#) in Ontario and a spokesperson for the project.

But the Enviropig's creators are hopeful the animal will eventually pass muster.

"This will be probably the most significant transgenic food to be approved. We're in new territory," Liss said.

The Problem With Pig Poop

Like all living things, pigs need phosphorous from their food, because the element plays a key role in the formation of bones, teeth, and cell walls as well as in a variety of cellular and organ functions.

Swine in the United States primarily eat corn, while those in Canada munch on cereal grains, including barley. But the kind of phosphorus that occurs naturally in those plants is indigestible without an enzyme called phytase, which pigs lack.

Most farmers feed their pigs this enzyme as a supplement. But ingested phytase isn't as effective at breaking down phosphorus as phytase created inside the pig would be, so a fair amount of the element gets flushed out in pig waste. That waste, in turn, can make its way into the water supply.

Enviropig would eliminate the need for added phytase, because the animal has been engineered to make its own. (Related: ["Rabbits Milked for Human Protein; Drug Soon for Sale?"](#))

Researchers spent more than a decade hunting for an enzyme in nature responsible for breaking down phosphorous, finally finding it in the genome of the bacterium *E. coli*. (Get a genetics overview.)

To make sure the modification would work in mammals, the team paired the *E. coli* genes with a mouse DNA promoter, a section of DNA that encourages replication of a specific segment—in this case the bacterial genes. Researchers then injected microscopic fertilized pig embryos with the mixture.

Early trials revealed that the bacterial enzyme was not only incorporated into the pig genome, it could be inherited by the genetically engineered pigs' offspring.

"We are now in the eighth generation of pigs, and it has been transmitted to all of those generations," said Cecil Forsberg, a University of Guelph microbiologist and lead researcher on the project.

"And from our testing, there is no change in the structure of the gene throughout those generations."

With the added genes, Enviropig is able to absorb more phosphorous from its feed, so less of the element ends up unused and excreted.

Greener Pig Also a Cost Saver?

Enviropig addresses not only environmental concerns but also societal challenges in pig farming, the University of Guelph researchers say.

In addition to cutting feed-supplement costs, Enviropig could help farmers comply with "zero discharge" rules in the United States that allow no nitrogen or phosphorous runoff from animal operations.

Right now, most pork producers meet this law by collecting pig waste in pits and lagoons until it can be treated or recycled as fertilizer—resulting in added expenses for the farmers. (Related: ["Human Waste Used by 200 Million Farmers, Study Says."](#))

"The cost to produce animals is increasing, putting the burden on farmers in a global marketplace," project spokesperson Liss said.

Now that Enviropig has reached a milestone, pork producers will be watching to see if the transgenic animal passes safety tests with the U.S. Food and Drug Administration, noted Paul Sundberg, vice president of science and technology for the U.S. [National Pork Board](#).

Industry professionals will also want to see a cost-benefit analysis, to be sure Enviropig will be a boon to the industry, Sundberg said.

"Pork producers are in favor of any technologies that can increase their competitiveness," he said.

So far, no transgenic animal has been approved for consumption in the United States. But in 2008 the FDA announced approval of the first human health product made from a genetically engineered animal.

The goat-derived anticoagulant, ATryn, is used for the prevention of blood clots in patients with a rare disease-causing protein deficiency.