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Let GM salmon swim through red tape

Genetically modified food is safe and could help end world hunger, argue GM proponents

With food shortages emerging as one of the globe's most pressing problems, scientists say that genetic modification (GM) techniques may well lead a second green revolution, if public opinion and red tape don't derail the effort first.

In the two decades since they first emerged, GM plants have started to gain worldwide acceptance, and form a substantial chunk of crops ranging from soya bean to corn.

But animals inserted with foreign genes to, say, grow faster or contain added nutrients remain stuck in a regulatory bottleneck.

All eyes are on the AquAdvantage Salmon, which is awaiting the final nod after lengthy evaluations by the United States Food and Drug Administration (FDA).

This Atlantic Salmon – inserted with genes from the Chinook Salmon and ocean pout so it can grow twice as fast – is in front of the queue to be the first GM animal approved for consumption.

This could then open the way for a host of other animals ranging from pigs that produce less polluting waste to cows that produce low-allergy milk.

Being first, however, has come at a price. It has taken 17 years, and some US\$67 million (S\$83 million) in investments so far, yet the salmon remains off dinner plates – even though the FDA has found that it is as safe to eat as any other salmon and does not present an environmental danger.

As the Singapore inventor of the transgenic salmon, Emeritus Professor Hew Choy Leong, puts it: "This is disruptive technology which changes the rules of the game, and that's why there have been so many difficulties and the approval process has taken so long."

A group of scientists, developers and investors lobbying for the fish to be approved as soon as possible worries that the "inexplicable bottleneck" suggests that the FDA's science-based regulatory review process for animal biotechnology products "has no predictable timeline and is holding up the development of an industry that promotes economic growth, innovation, competitiveness and job creation".

Conversely, the tide appears to be turning for GM crops, which are gaining acceptance after overcoming years of resistance from groups such as Greenpeace as well as the public.

According to the non-profit International Service for the Acquisition of Agri-Biotech Applications (ISAAA), there were 170 million ha of GM crops last year. This constitutes at least 10 per cent of the world's crop lands and represents a 100-fold increase from 1996, when GM crops were first commercialised.

"This makes biotech crops the fastest adopted crop technology in recent history," said Dr Clive James, the chair and founder of ISAAA, an organisation that shares the benefits of crop biotechnology with various stakeholders.

There is rising awareness, particularly in developing countries and among small farmers, about the benefits of planting GM crops, because of their increased yields, savings in fuel, time and machinery, reduced pesticide use, higher quality of product and more growing cycles, said the ISAAA.

Yet the delays for the AquAdvantage Salmon continue. Earlier this month, the FDA announced that it would be extending the public consultation process on its environmental assessment that was scheduled to end tomorrow. The agency said it was responding to "a request for an extension to allow interested persons additional time to submit



WHAT COULD BE ON THE MENU

AquAdvantage Salmon

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Enviropig

They look and behave like normal animals, but each creature contains genes from mice and E.coli bacteria, which have been inserted into their DNA to change the way the pigs process food. Regular pigs cannot easily digest phosphates in their feed such as corn and soya bean. The genetic modification allows the pigs to digest phosphates better, which means they are less polluting and cheaper to feed.



Flu-resistant chickens

These chickens do not spread bird flu, because scientists introduced an artificial gene to introduce a tiny portion of the bird flu virus into chicken cells. The birds become infected but, in the process, the virus becomes harmless to other poultry.



The breakthrough will potentially help to stop outbreaks from happening within and between poultry flocks.

Healing milk

Scientists altered the genome of goats, allowing them to produce milk containing genetic materials found in the malaria vaccine. In another project, goats were being altered with a single human gene that gave their milk bacterial fighting abilities that can protect against diarrhoea.



Vitamin-enhanced rice

Golden Rice contains beta carotene, a source of vitamin A. It was developed with genes from maize and a common soil micro-organism that together produce beta carotene in the rice grain.



The International Rice Research Institute is working with nutrition and agricultural research organisations to develop and evaluate Golden Rice as a potential new way to reduce vitamin A deficiency.

comments". In the meantime, the latest food scandal has hit the headlines, in the form of horse meat dressed as beef. The science says that neither a Black Beauty burger nor a sausage roll made from a pig with mouse DNA is a likely safety risk. But many people won't stomach either.

Critics argue that if a regulatory authority backed by all its science cannot detect safety lapses in regular foods, how can it be trusted to do so with transgenic products? So far there have been no credible reports of health hazards from eating GM foods, the scientists counter. In 2010, for instance, the

European Commission published a report summarising the results of more than 130 European Union-funded projects on safety of GMOs (genetically modified organisms). The projects, conducted by more than 500 independent research teams over more than 25

years, led the EU to conclude that "there is, as of today, no scientific evidence associating GMOs with higher risks for the environment or for food and feed safety than conventional plants and organisms".

In Singapore, the regulatory agency for GM foods is the Agri-Food and Veterinary Authority, which works closely with the Genetic Modification Advisory Committee here to ensure GM food safety.

Researchers also note that people and the environment face greater hazards in the form of pollutants from animal emissions and the liberal use of pesticides and fertilisers in conventional farming.

From 1996 to 2011, GM crops resulted in a saving of 473 million kg of pesticides, said ISAAA. In 2011 alone, they allowed reductions in carbon dioxide emissions of 23 billion kg – equivalent to taking 10.2 million cars off the road.

It is good news at a time when feeding the world is becoming more and more difficult.

Already, one in seven people goes hungry each day. And in the next 40 years, the global population is forecast to swell to nine billion from seven billion now.

GM foods – which are cheaper, easier to produce, and more environmentally friendly – could be a big part of the solution.

Indeed, Britain's chief scientist John Beddington, pointing to the perfect storm of growing human numbers, climate change and food shortages, has said repeatedly that it would become very hard to justify not using new technologies such as genetic modification.

Separate the science from the visceral response, said Prof Hew, who has more than once been confronted and shouted at by people for trying to "play God".

"One person told me he would not eat anything with DNA in it. How do I respond to a statement like that? As a scientist, I am just trying to play a part in solving the food shortage," he said.

DNA, or deoxyribonucleic acid, is found in all living things.

Contrary to the mad scientist image of an evil genius stitching animal parts together and creating a monster, genetic engineering is a precise science. It makes use of special biochemical scissors and glue which allow scientists to cut and paste specific genes from one living thing to another.

The newly introduced DNA brings new characteristics to the resultant organism. But when GM food is eaten, it is simply digested like any regular food.

But obstacles to development and commercialisation remain – lengthy tests and public resistance are the major challenges that GM food producers need to overcome.

Greater awareness of the food and how it is created will help to erase some of the prejudices against it. Environmental activist and former anti-GM protester Mark Lynas, for one, said that studying the science behind biotechnology converted him.

While people have died from eating organic food, there has not been a single fatality blamed on GM food consumption, he noted in a recent address to the Oxford Farming Conference.

"Desperately needed agricultural innovation is being strangled by a suffocating avalanche of regulations which are not based on any rational scientific assessment of risk," he said.

"The risk today is not that anyone will be harmed by GM food, but that millions will be harmed by not having enough food, because a vocal minority of people in rich countries want their meals to be what they consider natural."

In the latest waiting game, there is much more at stake than a mere fish.

If the FDA approves the AquAdvantage salmon, the world will follow suit, said Prof Hew, who has already had inquiries from farmers around the world interested in breeding the fish. And after the salmon, more animals and more food supplies may follow.

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