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Golden Rice: Lifesaver?

By **AMY HARMON**

ONE bright morning this month, 400 protesters smashed down the high fences surrounding a field in the Bicol region of the Philippines and uprooted the genetically modified rice plants growing inside.

Had the plants survived long enough to flower, they would have betrayed a distinctly yellow tint in the otherwise white part of the grain. That is because the rice is endowed with a gene from corn and another from a bacterium, making it the only variety in existence to produce beta carotene, the source of vitamin A. Its developers call it “Golden Rice.”

The concerns voiced by the participants in the Aug. 8 act of [vandalism](#) — that Golden Rice could pose unforeseen risks to human health and the environment, that it would ultimately profit big agrochemical companies — are a familiar refrain in the long-running controversy over the merits of genetically engineered crops. They are driving the desire among some Americans for mandatory “G.M.O.” labels on food with ingredients made from crops whose DNA has been altered in a laboratory. And they have motivated similar attacks on trials of other genetically modified crops in recent years: grapes designed to [fight off a deadly virus](#) in France, wheat designed to [have a lower glycemic index](#) in Australia, [sugar beets in Oregon](#) designed to tolerate a herbicide, to name a few.

“We do not want our people, especially our children, to be used in these experiments,” a farmer who was a leader of the protest told the Philippine newspaper [Remate](#).

But Golden Rice, which appeared on the [cover of Time Magazine in 2000](#) before it was quite ready for prime time, is unlike any of the genetically engineered crops in wide use today, designed to either withstand herbicides sold by Monsanto and other chemical companies or resist insect attacks, with benefits for farmers but not directly for consumers.

And a looming decision by the Philippine government about whether to allow Golden Rice to be grown beyond its four remaining field trials has added a new dimension to the debate over the technology’s merits.

Not owned by any company, Golden Rice is being developed by a nonprofit group called the [International Rice Research Institute](#) with the aim of providing a new source of vitamin A to people both in the Philippines, where most households get most of their calories from rice, and eventually in many other places in a world where rice is eaten every day by half the population. Lack of the

vital nutrient causes blindness in a quarter-million to a half-million children each year. It affects millions of people in Asia and Africa and so weakens the immune system that some two million die each year of diseases they would otherwise survive.

The destruction of the field trial, and the reasons given for it, touched a nerve among scientists around the world, spurring them to counter assertions of the technology's health and environmental risks. On a petition supporting Golden Rice circulated among scientists and signed by several thousand, many vented a simmering frustration with activist organizations like Greenpeace, which they see as playing on misplaced fears of genetic engineering in both the developing and the developed worlds. Some took to other channels to convey to American foodies and Filipino farmers alike the broad [scientific consensus](#) that G.M.O.'s are not intrinsically more risky than other crops and can be reliably tested.

At stake, they say, is not just the future of biofortified rice but also a rational means to evaluate a technology whose potential to improve nutrition in developing countries, and developed ones, may otherwise go unrealized.

“There's so much misinformation floating around about G.M.O.'s that is taken as fact by people,” said [Michael D. Purugganan](#), a professor of genomics and biology and the dean for science at New York University, who sought to calm health-risk concerns in a [primer](#) on GMA News Online, a media outlet in the Philippines: “The genes they inserted to make the vitamin are not some weird manufactured material,” he wrote, “but are also found in squash, carrots and melons.”

Mr. Purugganan, who studies [plant evolution](#), does not work on genetically engineered crops, and until recently had not participated in the public debates over the risks and benefits of G.M.O.'s. But having been raised in a middle-class family in Manila, he felt compelled to weigh in on Golden Rice. “A lot of the criticism of G.M.O.'s in the Western world suffers from a lack of understanding of how really dire the situation is in developing countries,” he said.

Some proponents of G.M.O.'s say that more critical questions, like where biotechnology should fall as a priority in the efforts to address the root causes of hunger and malnutrition and how to prevent a few companies from controlling it, would be easier to address were they not lumped together with unfounded fears by those who oppose G.M.O.'s.

“It is long past time for scientists to stand up and shout, ‘No more lies — no more fear-mongering,’ ” said [Nina V. Fedoroff](#), a professor at the King Abdullah University of Science and Technology in Saudi Arabia and a former science adviser to the American secretary of state, who helped spearhead the [petition](#). “We're talking about saving millions of lives here.”

Precisely because of its seemingly high-minded purpose, Golden Rice has drawn suspicion from

biotechnology skeptics beyond the demonstrators who forced their way into the field trial. Many countries ban the cultivation of all genetically modified crops, and after the rice's media debut early in the last decade, [Vandana Shiva](#), an Indian environmentalist, called it a “Trojan horse” whose purpose was to gain public support for all manner of genetically modified crops that would benefit multinational corporations at the expense of poor farmers and consumers.

In a 2001 article, “[The Great Yellow Hype](#),” the author Michael Pollan, a critic of industrial agriculture, suggested that it might have been developed to “win an argument rather than solve a public-health problem.” He cited biotechnology industry advertisements that featured the virtues of the rice, which at the time had to be ingested in large quantities to deliver a meaningful dose of vitamin A.

But the rice has since been retooled: a bowl now provides 60 percent of the daily requirement of vitamin A for healthy children. And [Gerard Barry](#), the Golden Rice project leader at the International Rice Research Institute — and, it must be said, a former senior scientist and executive at Monsanto — suggests that attempts to discredit Golden Rice discount the suffering it could alleviate if successful. He said, too, that critics who suggest encouraging poor families to simply eat fruits and vegetables that contain beta carotene disregard the expense and logistical difficulties that would thwart such efforts.

Identified in the infancy of genetic engineering as having the potential for the biggest impact for the world's poor, beta-carotene-producing rice was initially funded by the Rockefeller Foundation and the European Union. In a decade of work culminating in 1999, two academic scientists, Ingo Potrykus and Peter Beyer, finally switched on the production of beta carotene by adding daffodil and bacteria DNA to the rice's genome. They licensed their patent rights to the agribusiness company that later became Syngenta, on the condition that the technology and any improvements to it would be made freely available to poor farmers in the developing world. With the company retaining the right to use it in developed countries, potentially as an alternative to vitamin supplements, Syngenta scientists later improved the amount of beta carotene produced by substituting a gene from corn for the one from daffodil.

If the rice gains the Philippine government's approval, it will cost no more than other rice for poor farmers, who will be free to save seeds and replant them, Dr. Barry said. It has no known allergens or toxins, and the new proteins produced by the rice have been shown to break down quickly in simulated gastric fluid, as required by World Health Organization guidelines. A mouse feeding study is under way in a laboratory in the United States. The potential that the Golden Rice would cross-pollinate with other varieties, sometimes called “genetic contamination,” has been studied and found to be limited, because rice is typically self-pollinated. And its production of beta carotene does not appear to provide a competitive advantage — or disadvantage — that could affect

the survival of wild varieties with which it might mix.

If Golden Rice is a Trojan horse, it now has some company. The Bill and Melinda Gates Foundation, which is supporting the final testing of Golden Rice, is also underwriting the development of crops tailored for sub-Saharan Africa, like cassava that can resist the viruses that routinely wipe out a third of the harvest, bananas that contain higher levels of iron and corn that uses nitrogen more efficiently. Other groups are developing a pest-resistant black-eyed pea and a “Golden Banana” that would also deliver vitamin A.

Beyond the fear of corporate control of agriculture, perhaps the most cited objection to G.M.O.’s is that they may hold risks that may not be understood. The decision to grow or eat them relies, like many other decisions, on a cost-benefit analysis.

How food consumers around the world weigh that calculation will probably have far-reaching consequences. Such crops, *Scientific American* declared in an editorial last week, will make it to people’s plates “only with public support.”

Greenpeace, for one, dismisses the benefits of vitamin supplementation through G.M.O.’s and has said it will continue to oppose all uses of biotechnology in agriculture. As Daniel Ocampo, a campaigner for the organization in the Philippines, put it, “We would rather err on the side of caution.”

For others, the potential of crops like Golden Rice to alleviate suffering is all that matters. “This technology can save lives,” one of the petition’s signers, Javier Delgado of Mexico, wrote. “But false fears can destroy it.”

Amy Harmon is a national correspondent for The New York Times.

This article has been revised to reflect the following correction:

Correction: August 24, 2013

An earlier version of this article misspelled the Philippine region where protesters destroyed a field growing genetically modified rice. It is the Bicol region, not Bricol.

