

## Anti-GMO activists brandish disputed Stone-Glover Golden Rice paper in attacks on Nobel laureates

When anti-GMO advocacy groups launched what appears to be a coordinated counter-attack on the [letter released June 29 by 107 Nobel Laureates](#) criticizing Greenpeace's campaign against nutrition-enhanced Golden Rice, they universally cited a recent journal article published by two long-time GMO skeptics, Washington University St. Louis anthropologist Glenn Stone and University of Sussex researcher Dominic Glover.

[Wrote GMWatch](#) in a post on June 30:

... as Prof Glenn Davis Stone [pointed out](#) in a peer-reviewed [study](#) co-authored with development expert Dominic Glover, GM golden rice still isn't ready and there's no evidence that activists are to blame for the delay.

The claim by GMWatch and other anti-GMO sites is wrong. Stone and Glover did not conclude in their published article that "activists were not to blame" for the delays. Rather, they catalogued their narrative of why the Green Revolution has failed—an almost absurd notion considering the tripling of production and sharp drop in hunger as a result of increased food production over the past 50 years—and why Golden Rice has taken so long, concluding:

It is still years away from field introduction and even then, may fall short of lofty health benefits still cited regularly by GMO advocates.

The disembeddedness of Golden Rice that boosts its value as a public relations vehicle has ... been the main impediment in it reaching farmers' fields, as it has proved difficult to breed into varieties that grow well specifically in the Philippines.

The specific statement that 'activists were not to blame' for the delay in introducing the rice originated not with the paper, but with an [interview Stone gave to the Washington University public relations office](#) to promote his paper:

"Golden Rice is still not ready for the market, but we find little support for the common claim that environmental activists are responsible for stalling its introduction. GMO opponents have not been the problem," said lead author Glenn Stone, professor of anthropology and environmental studies in Arts & Sciences.

Golden Rice has been a difficult rice to develop, and some scientific challenges do remain. But while most of the paper focuses on cultural, historic, and societal aspects of Golden Rice, most of these scientific claims, according to a number of rice experts, are not accurate.

The Stone-Glover narrative of the 'failures' of modern agriculture and Golden Rice's has been sharply challenged by Adrian Dubock, who has served as the project manager for the project since 2008 and is the executive secretary of the Golden Rice Humanitarian Board since 2010, in a [letter posted exclusively by the Genetic Literacy Project](#).

It is remarkable, that Stone & Glover, despite over 100 references to their paper ([including one of mine](#) from 2014) and 13 individuals acknowledged—didn't think to contact either of the inventors or myself for a perspective, or follow up on two other papers of mine referenced in the one they did read: [Golden Rice: a long-running story at the watershed of the GM debate](#) and [The politics of Golden Rice](#).

...it is clear how the suspicion of GMO-crops induced by an out of date Cartagena Protocol has been harvested by anti-globalization-anti-gmo-activists for fund raising and cynically by the organic food industry also to further their commercial claims.

Glover and Stone are politely rude about the motivations of those involved with Golden Rice. It is untrue that Golden Rice has been for "15 years ....a public relations vehicle", and those involved are not responsible for how others refer to the project.

There are so many other aspects of Glover and Stone's analysis of Golden Rice which are selectively chosen to further their thesis, that it brings into doubt their assertion that "we do not champion or disparage the forms of embeddedness or disembeddedness we have described in the three rice worlds. [Golden Rice, The Green Revolution, and heirloom seeds in the Philippines]."

GLP note: For an analysis of the role the Cartagena Protocol and anti-GMO activism has played in delaying the development of Golden Rice, see: ["Activists played 'no role' in delaying Golden Rice'? Evidence challenges anti-GMO claim"](#), by [Amy Porterfield Levy](#) & [Julie Kelly](#)

## **Science behind Golden Rice**

Golden Rice was first shown to be workable in Switzerland by researchers Ingo Potrykus and Peter Beyer in 1999. It was almost immediately hailed as a life saver, because the rice had been engineered to ultimately produce Vitamin A, a much needed nutrient to prevent blindness and death in several third-world countries. Most poor people in countries like the Philippines, India, Bangladesh, and other parts of Asia subsist almost entirely on rice, and suffer disproportionately from Vitamin A deficiency, even today. The deficiency hits young children the hardest.

In addition, the modified rice was not patented or licensed to any company for development. It has undergone development research at the International Rice Research Institute (IRRI) in the Philippines.

However, from the beginning, Golden Rice presented significant scientific challenges. First, [Potrykus said](#), was the issue of transferring an entire biochemical pathway, which synthesized beta-carotene, into

another organism:

Until then, only single gene transfers had been done. Here, the entire biochemical pathway, from the last detectable precursor, geranylgeranyl-pyrrophosphate, to beta-carotene had to be engineered. Genes for four missing enzymes plus a selectable marker gene had to be isolated and transformed into the rice genome.

This took eight years. Today's Golden Rice "is produced with two genes—one from maize and one from a soil bacterium, and providing up to 30 micrograms pro-vitamin A per gram of endosperm. And there is no marker gene left," Potrykus said.

At first, the researchers grew the Golden Rice version in Japonica rice, and then looked for ways to get the Vitamin A trait into other varieties.

But, the initial type of Golden Rice did not yield as much beta-carotene as researchers had hoped. They looked to two biosynthesis transgenes to see where a bottleneck (or in biochemical parlance, the rate-limiting step) existed. By using maize and rice genes, a second generation Golden Rice was introduced that [researchers said](#) could accumulate "up to 37 µg/g carotenoids, of which 31 µg/g was β-carotene, as compared to the first generation, where only 1.6 µg/g were obtained."

Finally, there was a question of overall yield. The Golden Rice variety did not have yields that competed with traditional rice varieties, and scientists have been working on boosting that yield while maintaining accumulations of beneficial beta carotenes. According to IRRI manager Mardy Cristobal, "the project continues to make good progress, with the latest Golden Rice product entering Phase 3 (advanced development) during the last year."

### **So, what about latest criticism?**

Contrary to Stone and Glover's claim that Golden Rice could not be grown in a number of varieties, the first tests of Golden Rice were carried out in a Japonica variety of rice, but later shown to be able to be grown in Indica rice varieties. According to Dubock:

Due to technology limitations it was not possible to directly transform into Indica rices. (But) using conventional breeding techniques the nutritional trait can be introduced into any locally adapted and preferred variety of rice so that its agronomy, preparation and taste will be the same.

Dubock also contested Stone and Glover's claim that Golden Rice doesn't store well. Golden Rice research had always concentrated on including storage ability as one of the rice's beneficial traits. And the rice does store well.

“Rice harvested in March 2011 still contains beta-carotene, probably at useful levels indicated by the color, 5-1/2 years after harvest,” Dubock wrote.

Dubock and others—including the Nobel laureates—also emphasize that Vitamin A deficiency remains a problem, particularly in poor and remote parts of the world. And fortified rice is the most efficient way to get nutrients to these people.

“Vitamin A deficiency remains a killer in many parts of the developing world,” wrote Dubock. “There is no new data on the mortality reducing impact of providing a source of Vitamin A to those that need it. (And) data have demonstrated that the 23-34 percent of global under-five-years child mortality can be prevented by an accessible source of Vitamin A.”

The IRRI has presented figures underscoring that a number of indicators of malnutrition, including stunted growth, underweight, and thinness, while improving, still remain significant public health problems.

Yet the major impediment, say researchers who challenge the Stone-Glover hypothesis, is the staunch opposition to genetically engineering by anti-GMO activist groups, such as Greenpeace. They have scared away research dollars and prompted regulators to set up almost unscalable regulator hurdles that make little scientific sense. In a [speech accepting](#) the Bertebos Foundation Prize in 2008, Golden Rice co-inventor Ingo Potrykus pointed to regulation as “the outstanding hurdle and the main cause for ten years’ delay.”

Had Golden Rice not been genetically modified, it would have been in use since 2002. Now it is taking 10 years longer, causing up to 400,000 unnecessary deaths in India alone, for no other reason than the regulatory system established world-wide with financial support from the United Nations. If there hadn’t been support from the private sector, which is experienced in the regulatory requirements and intellectual property rights, Potrykus and Beyer would have given up and Golden Rice would have been no more than an academic exercise.

And these regulatory processes have come at a cost. A 2014 paper by agricultural economists David Zilberman and Justus Wesseler estimated that opposition has cost \$2 billion for the past 10 years.

According to them, “Governments must perceive additional costs that overcompensate the benefits of the technology to explain the delay in approval.” The annual “perceived cost” of about \$200 million a year, the authors wrote, “is an indicator of the economic power of the opposition towards Golden Rice resulting in about 1.4 million life years lost over the past decade in India.”

Golden Rice remains a scientific challenge involving multiple genes and transferring entire biochemical pathways. However, many, if not most, of the scientific issues have been identified and are being addressed. Stone and Glover may disagree with the world’s top independent scientists, including almost half of all living Nobel Prize winners; that does not make their views less ideological, however.

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