Golden Rice

What?
In the developing world, around 40 percent of children under the age of five have compromised immune systems due to Vitamin A deficiency (VAD). This greatly increases the risk of severe illnesses from common childhood infections, causes blindness and leads to hundreds of thousands of unnecessary deaths.

In these countries, people often get about 80 per cent of their daily calories from rice. Knowing this, in the '90s, plant geneticist Ingo Potrykus thought he might be able to help: he would develop a rice that contained beta-carotene. Beta-carotene gives carrots and other vegetables their orange colour; in our bodies it is converted to Vitamin A.

How?
Rice produces β-carotene in the leaves but not in the grain. In *Golden Rice* two genes have been inserted into the rice genome, leading to the production and accumulation of β-carotene in the grains. Both genes are naturally involved in carotene biosynthesis. The current version of Golden Rice has two *transgenes*, or genes from another species. One is from corn and the other comes from a commonly-ingested soil bacterium.

Accessibility
Golden rice will be made available to developing countries as part of a coordinated humanitarian project. Seed will be given to subsistence farmers free of charge and farmers will be able to save and replant Golden Rice seeds.

Original Research
Started as research supported by the Rockefeller Foundation initiative in 1982, Golden Rice was the product of an eight-year project by Ingo Potrykus of the Swiss Federal Institute of Technology and Peter Beyer of the University of Freiburg. In 1991 The International Rice Research Institute (IRRI) in the Philippines became the first licensee for what became known as Golden Rice. GR2E was delivered to The International Rice Research Institute (IRRI) in 2006.

Commercial Development
The inventors decided an industrial partner was necessary to get the rice to the people who needed it. Syngenta acquired the commercial rights to the technology, with an agreement that humanitarian use would be separate from commercial use. The company was instrumental in developing a product, however, as there is practically no vitamin A deficiency in the developed world, in 2005 Syngenta renounced its commercial interest and passed the technology rights and the improvements, as seed, to the inventor's licensees, including IRRI, in 2006.

According to IRRI, in the Philippines and elsewhere the licensing terms ensure that Golden Rice varieties will cost no more than their conventional equivalents.

Registration

Applications have been lodged with the governments of the Philippines to grant a biosafety permit for conducting GR2E Golden Rice field trials. In 2015, the Bangladesh Rice Research Institute (BRRI) started field trials for environmental and food safety assessment of variety *GR-2 E BRRI dhan29* Golden Rice.

Applications for food or food and feed safety review of GR2E Golden Rice have been submitted to the US Food and Drug Administration, Food Standards Australia New Zealand, and to Health Canada.

In its notice of decision dated March 16, 2018, Health Canada declared that "*changes made in this rice variety did not pose a greater risk to human health than rice varieties currently available on the Canadian market*," further noting that "*GR2E would have no impact on allergies*," and that there were no differences in the nutritional value of GR2E compared to other traditional rice varieties available for consumption except for increased levels of provitamin A.

Consumer concerns and answers

GM technology might interfere with existing vitamin A supplementation and fortification programs

Many individuals with vitamin A deficiency live in areas that are not covered by these programs. These programs are also very expensive (millions of dollars / country / year) and are therefore not sustainable.

Vitamin A consumption can be increased by producing other crops high in vitamin A

These crops are not available throughout the year, are often perishable, or do not grow in the areas where vitamin A deficiency is highest. Golden rice is a sustainable source of food that is available through out the year.

Greenpeace says people would need a huge quantity of Golden Rice each day to get enough vitamin A

Greenpeace and other groups against Golden Rice are using old data based on the original variety from the 1990s. The new variety produces up to 23 times more beta-carotene than the original. Consuming a single cup of Golden Rice could supply 50 per cent of the recommended daily allowance of Vitamin A for an adult.

Commercialization challenges

Greenpeace continues to fight the introduction of Golden Rice, but 129 Nobel laureates signed a letter urging Greenpeace to end its opposition to genetically modified organisms (GMOs). The letter asks Greenpeace to cease its efforts to block introduction of a genetically engineered strain of rice that supporters say could reduce Vitamin A deficiencies causing blindness and death in children in the developing world.

References

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