

[Golden Rice: When Science Goes Awry](#)

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OPINION

Golden Rice: When Science Goes Awry

Vitamin "A" rice is no cure for deficiency, says India's renowned environmental activist

Dr. Vandana Shiva

Dr. Vandana Shiva is one of India's and the world's foremost environmental activists. She holds a master's degree in particle physics and a Ph.D. in the philosophy of science, and is the author of eleven books. She gave up an academic career to start the Research Foundation for Science Technology and Natural Resource Policy in India. She is a critic of the Green Revolution, believing it has caused serious problems, especially in reducing the varieties of plants grown by farmers. Here, at the request of Hinduism Today, she critiques the creation of a genetically engineered rice which supplies vitamin A [see also "GM Foods: Gift or Curse," July/August, 2000].

Golden rice has been heralded as the miracle cure for malnutrition and hunger, of which 800 million members of the human community suffer. Herbicide-resistant and toxin-producing genetically modified (GM) plants, such as "bt corn," can be objectionable because of their ecological and social costs. But who could possibly object to rice engineered to produce vitamin A, a deficiency found in millions of children,

largely in the Third World? An estimated 350,000 children go blind yearly from the deficiency. Biological scientist Mary Lou Guerinot stated in an article, "The Green Revolution Strikes Gold" (Science, January 14, 2000), "One can only hope that this application [vitamin A rice] of plant genetic engineering to ameliorate human misery without regard to short-term profit will restore this technology to political acceptability." In other words, she believes vitamin A rice can be a kind of "poster child" for the promotion of GM foods in general.

Unfortunately, vitamin A rice is a hoax, and it will bring further dispute to plant genetic engineering where public relations exercises seem to have replaced science in promotion of untested, unproven and unnecessary technology.

The problem is that vitamin A rice will not only not alleviate vitamin A deficiency, it will seriously aggravate it. First, no actual usable strain of the rice is ready for distribution to farmers. Second, the current goal of the developers is just 33.3 RE ("retinol equivalents"--the units in which vitamin A is measured) per 100 grams of rice, according to a report "Vitamin A: Background Information, Vitamin A Deficiency Status Worldwide and in India" provided to Hinduism Today by Dr. Manju Sharma of India's Department of Biotechnology and dated April 11, 2000.

Technically speaking, plants themselves do not provide vitamin A (so named because it was the first vitamin discovered). Plants provide the chemical betacarotene (the orange in carrots) which the body converts to vitamin A in a ratio of about six to one. For simplicity of discussion, we'll just

talk about "vitamin A," realizing that all the numbers refer to the body's actual production of vitamin A, and not the amounts of betacarotene supplied.

Since the daily average requirement of vitamin A for a child is 400 RE, and one serving of 100 grams (three ounces) provides just 33 RE, it would require some 1.2 kilos (2.6 pounds) of rice by dry weight to meet the requirement. This is an impossible quantity, more than 11 cups of cooked rice! An adult's requirement is 2.4 kilos.

Even if the quantity of vitamin A were increased, there are still problems. Raw, milled rice has a low content of fat. Since fat is necessary for vitamin A uptake, this will aggravate vitamin A deficiency. It is also low in protein, which means fewer needed carrier molecules; and it is low in iron, which plays a vital role in the body's conversion of betacarotene into vitamin A.

Finally, there are the issues of actually introducing the rice to farmers in some of the poorest and most backward areas of the world. Various strains of vitamin A rice would have to be developed for different environments. Farmers would have to be convinced to grow the rice and consumers to eat it. That could be no easy matter in areas where people cannot be convinced even to eat the more nutritious, unpolished brown rice instead of polished white rice--because brown rice is for "the poor."

There already exists a far more efficient route to removing vitamin A deficiency. That is biodiversity conservation and

propagation of naturally vitamin A rich plants in agriculture and diets. A report by W.C. Edmundson and S.A. Edmundson states, "Vitamin A blindness is both the easiest and the cheapest major nutritional illness to cure. This deficiency can be easily prevented by the inclusion of green leaves and yellow fruits and vegetables in the diet." (www.midcoast.com.au/~wedmunds/c5-vita.htm)

But those developing and endorsing vitamin A rice do not discuss this existing strategy and ignore the diversity of plants naturally rich in A. In fact, a report of the Major Science Academies of the World--Royal Society, U.K., National Academy of Sciences of the USA, The Third World Academy of Science, Indian National Science Academy, Mexican Academy of Sciences, Chinese Academy of Sciences, Brazilian Academy of Sciences--on Transgenic Plants and World Agriculture has stated that "Traditional breeding methods have been unsuccessful in producing crops containing a high vitamin A concentration and most national authorities rely on expensive and complicated supplementation programs to address the problem."

It appears to me from this report that the world's

top scientists suffer a more severe form of blindness than children in poor countries. The statement that "traditional breeding has been unsuccessful in producing crops high in vitamin A" is not true, given the diversity of plants and crops that Third World farmers, especially women, have bred and used which are rich sources of vitamin A, such as coriander, amaranth, cabbage, curry leaves, carrot, pumpkin, mango, drumstick leaves, fenugreek leaves, radish leaves and jackfruit. The drumstick tree (*moringa oleifera*) grows easily in the tropics and an ounce of leaves provides a daily dose of vitamin A.

Even the World Bank has admitted that rediscovering and using local plants and conservation of vitamin A rich, green, leafy vegetables and fruits have dramatically reduced the number of threatened children over the past 20 years in very cheap and efficient ways. Women in Bengal use more than 200 varieties of field greens. Over three million people have benefitted greatly from a food-based education project for removing vitamin A deficiency by increasing vitamin A availability through home gardens. The higher the diversity of crops, the better the

uptake of vitamin A, as well as many other nutrients. Diversity combats malnutrition in general.

The reason there is vitamin A deficiency in India in spite of the country's rich biodiversity and indigenous knowledge base is that the Green Revolution technologies wiped out biodiversity by converting mixed cropping systems to monocultures of wheat and rice and by spreading the use of herbicides which destroy field greens.

A March, 2000, report by Genetic Resources Action International (www.grain.org/publications/reports/malnutrition.htm) concurs. "As a solution to vitamin A deficiency, genetic engineering is part of the problem, not the solution. Vitamin A deficiency rarely occurs in isolation. It is only one of a whole range of nutrients, the lack of which occurs within the context of poverty, environmental degradation and social disparity. Technical fixes such as golden rice only treat the symptoms of micronutrient deficiency while reinforcing the underlying problem, which is caused by the

decline in the diversity of food that is being grown, produced and consumed."

In spite of these effective and proven alternatives, a technology transfer agreement has been signed between the Swiss government and the government of India for the transfer of genetically engineered vitamin A rice to India. But there are many obstacles. According to a New York Times report of November 21, 2000, "Golden rice has remained under lock and key since it was created more than a year ago. Meanwhile, Dr. Potrykus [the principal inventor] has struggled to free it from a complicated web of more than 70 patents and legal agreements covering items as diverse as DNA sequences and the techniques he and his colleagues used to insert new genes in the rice. He is also racing against an

effort to pass legislation that could prohibit the export of genetically modified organisms from Switzerland." Already it is illegal for anyone in Switzerland to consume this experimental rice.

Publicity to the contrary, vitamin A rice is not being given away "free." It is controlled by Syngenta, now the largest agricultural biotechnology company in the world. They plan to market the rice in developed countries and give it away in developing countries to farmers making less than ^{us}\$10,000 a year. However, they retain all rights to the patents in the process. Further, the company is relying upon public sector research labs in India and elsewhere who have the expertise to develop the necessary regional strains.

The real test for Syngenta and the others who hold rights would be to give up any patent claims to rice, now and in the future. Failing that, the announcement giving royalty-free licenses for the rice can only be taken as a ruse to establish a monopoly over rice production, and reduce the rice farmers of India into bio-serfs. While the complicated technology transfer package of "golden rice" will not solve vitamin A problems in India, it is a very effective strategy for corporate takeover of rice production, using the involvement of the public sector as a Trojan Horse.

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