

THE ROCKEFELLER FOUNDATION

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Peter Melchett wrote suggesting that it would be useful if I responded to the report by Dr. Vandana Shiva entitled "The Golden Rice Hoax". I am pleased to do so and I am also enclosing background information on Vitamin A deficiency disorders and the Foundation's role in the development of Golden Rice that you may find informative.

First, it should be stated that we do not consider Golden Rice the solution to the vitamin A deficiency problem. Rather, it provides an excellent complement to fruits, vegetables and animal products in the diet, and to various fortified foods and vitamin supplements.

Complete balanced diets are the best solution, but the poorer families are, the less likely it is that their children will receive a balanced diet and the more likely they will be dependent on cheap food staples such as rice. This is particularly true in the dry seasons when fruits and vegetables are in short supply and expensive. Animal products are good sources of vitamin A, but will be unavailable to people on vegetarian diets. Unfortunately, in many cases, the bioavailability of sources of vitamin A is very low in green vegetables. And, the more rural these families are the less likely their children will be reached regularly and effectively by Vitamin A fortification and supplementation programs. Still, all these sources can and do make important contributions.

In her comments Vandana Shiva ignores the fact that Vitamin A-deficiency disorders result from a deficiency of Vitamin A, not a complete absence of Vitamin A in the diet. Vitamin A deficient individuals are lacking 10%, 20% or 50% of their daily requirements, not 100%. Hence, any additional contribution toward daily requirements would be useful. We calculated that the best Golden Rice lines reported in *Science* could contribute 15% - 20% of the daily requirements.

It should also be noted that the paper published in *Science* reported on the very first set of rice plants producing beta-carotene in the grain. The inventors have since made further improvements both in the level of

beta-carotene production and with the elimination of the antibiotic resistance gene.

Note also that if women consume this added source of vitamin A, it will improve their status, thereby increasing the concentration of vitamin A in the breast milk, a secondary but important source of vitamin A intake for young infants. The fact that hundreds of millions of children remain Vitamin A deficient indicates that more needs to be done, complementary strategies need to be tried, and that Golden Rice also has the potential to make important contributions.

I do not know exactly what point Dr. Shiva is trying to make in the section on transferring the technology to India. Yes, needs assessments are being conducted so that the trait can be transferred to varieties grown where the beta-carotene is most needed. She seems to think that Indians are too dependent on rice. That may or may not be true, but even so, I do not see why we should not try to make it a more nutritious food. Where possible, scientists do use conventional breeding to improve the nutrition of crops, including increased beta-carotene production, but this was not possible with rice.

Finally, I agree with Dr. Shiva that the public relations uses of Golden Rice have gone too far. The industry's advertisements and the media in general seem to forget that it is a research product that needs considerable further development before it will be available to farmers and consumers.

I hope these comments and the enclosures are useful.

Gordon Conway

Encls: Papers:

1. Vitamin A ...role of Rockefeller Foundation - Gary Toenniessen
2. Vitamin A Disorders - Dr. A. Sommer