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Reburnishing Golden Rice

The revelation last month that Syngenta has mistakenly distributed an unapproved variety of GM corn containing an ampicillin resistance marker over the past four years reveals a monumental foul up. It's ironic then that the same company deserves credit for a classic piece of industrial development applied to a public good. Syngenta has brought the world 'Golden Rice 2,' an improved version of transgenic rice engineered to produce β-carotene (provitamin A). The company has developed the crop to the point where it might now fulfill its promise as a remedy for certain forms of malnutrition that principally affect people in developing countries.

Golden Rice first burst onto the scene five years ago. It was heralded then by some as biotech's solution to a staggering human health crisis: vitamin A deficiency, which is responsible for 3,000 deaths per day and 500,000 cases of infant blindness per year. The problem is that Golden Rice was miscast as a panacea for the world's poor. In fact, it is one of many solutions that need to be developed in tandem, including educational initiatives to promote consumption of fruit, vegetables and animal products, local efforts to fortify existing food staples with vitamin A and international programs to distribute dietary supplements in developing countries.

Low-tech solutions by themselves, however, can only do so much. The poorer the family, the less likely they are to receive a balanced diet, particularly in times of famine when fruit and vegetables are in short supply. And the more rural the family, the smaller the chance they will get to hear about educational programs or benefit from vitamin A–fortified foods or supplements distributed by aid programs.

Ingo Potrykus, one of the codevelopers of the original Golden Rice strain, understood this. He developed β-carotene–enriched rice as a biological solution to the same problem, one that is much simpler. A single Golden Rice grain potentially allows a subsistence farmer to produce 1,000 grains of rice, from which might be produced 1,000,000 seeds, and so on. From one kernel, a farmer could grow 20,000 tons of rice in two years after four generations. And Golden Rice has fewer cost and aid implications: educational programs and vitamin supplements need annual budgets, networks for delivery, and they foster dependency. Rice seed, on the other hand, can be replanted each year at no extra cost to the farmer.

This argument would be compelling were it not for the fact that even the best lines of the original Golden Rice accumulated β-carotene to levels that supply only 15–20% of the recommended dietary allowance (RDA) for vitamin A. Biotech opponents, such as Greenpeace, have seized on this to claim that Golden Rice is 'a technical failure' because malnourished children would need to consume kilograms of rice to attain any tangible benefit (a position that conveniently ignores the reality that most people are only partly deficient in vitamin A and require only a small supplement to their daily carotenoid intake). Even last month, Greenpeace claimed in a press release that Golden Rice would "exacerbate malnutrition and undermine food security because it encourages a diet based on a single industrial staple food."

What Syngenta has now done in Golden Rice 2 is to replace the daffodil phytoene synthase gene with the equivalent gene from maize (p. 482). The consequence is that the new strain accumulates levels of the provitamin A that are more than 20-fold higher than those of the original. Syngenta scientists estimate that Golden Rice 2 could provide 50% of the RDA for vitamin A, although overall bioavailability would depend on the presence of dietary oils and proteins.

This is just the sort of thing that happens when you set goal-focused industrial R&D on a problem: they get on it and solve it. It might not always be pretty science. It might not always offer huge mechanistic insights or fundamental understanding. But it works and it usually works quite quickly. Unlike Golden Rice, which was the product of an academic collaboration between the groups of Potrykus and Peter Beyer with funding from the Rockefeller Foundation, the new rice strain is entirely a product of Syngenta's corporate R&D funding. Does that mean that the company aims to monopolize on its valuable product through exhorbitant licenses or sales? Actually no, not at all.

Syngenta is a member of the Humanitarian Golden Rice Network, which has obtained free licenses for humanitarian use of the necessary technology from more than 32 different companies and universities. The company will work with breeders in the public rice research institutions in Bangladesh, China, India, Indonesia, South Africa, the Philippines and Vietnam to make locally adapted varieties of Golden Rice 2 freely available to small-scale farmers with incomes less than $10,000. Once approved for release, varieties directly bred from Syngenta's rice will become the farmer's property, which they will be able to resow year after year without payment.

Greenpeace, Friends of the Earth and their political allies in European governments and nongovernmental organizations will not welcome Golden Rice 2. They will continue to reject and stall biotech products at the mere hint of a transgene, no matter what the humanitarian value of the crop and no matter how spurious the environmental concerns. But there comes a time when arguments against a GM product that could help prevent blindness in hundreds of thousands and death in millions each year should be seen for what they are: ideological bigotry.

Golden Rice is an exception to the rule that we don't give away gold or grain for free. It cannot change the way the world works. And it cannot reverse all the health or economic inequities that exist around the globe. But it can change for the better the plight of the world's malnourished, if only those rigidly opposed to GM crops would let it.