

Genetically Modified Foods: Benefits and Risks

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Traditional and Transgenic

Traditional Process:

Related species of a food-producing plant are interbred or “crossed.” During the process homologous recombination occurs. This is a molecular process by which one member (allele) of a pair or series of genes at a particular location of a chromosome become separated from other members and replaced by a similar, but different, allele. It is a same-site (homologous) exchange.

Result:

Over many years, genetic recombination results in a different combination of genes for an organism’s offspring than that of the original organism. Traits of one organism are introduced into a new genetic background (e.g., a slightly different plant) in order to obtain a plant with desired characteristics of each. For instance, an insect-resistant plant may be crossed with a plant that has high food yield but is susceptible to insects in the hope of obtaining a new variety that maintains high yield but also is more resistant to insects.

Goal:

To obtain new crops with certain desirable characteristics.

Transgenic process:

New plants are genetically engineered by adding one or more genes to a plant’s genome through a process often referred to as “transformation”—the genetic alteration of a cell resulting from the introduction of new genetic material (DNA or RNA). There are many techniques for transferring, or inserting, the DNA.

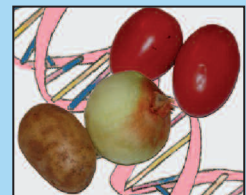
Result:

The new plant (the genetically modified organism, or GMO) is created by the introduction of the new genetic information into the plant’s genome. For instance, a gene from a fish that does not easily freeze may be inserted into a tomato to produce a new plant that does not easily freeze. The process can produce a plant with a desired trait more rapidly than traditional processes because most of the plant’s genome is not altered.

Goal:

To obtain new crops with certain desirable characteristics.

Both involve the alteration of genetic patterns in order to improve a plant’s value. The value of the plant is most often associated with its resistance to insects and disease, hardiness or adaptability to different climactic conditions (sometimes discussed in terms of “tolerance to environmental pressure”), and ultimately its food crop yield. The latter can be broken into categories of taste, nutritional content and value, and appearance, among others.



Rice and Reality

What is Golden Rice?

Golden Rice is rice that has been genetically modified to contain pro-vitamin A in the form of beta-carotene. When a food containing beta-carotene is eaten, it is converted in the body into vitamin A. The same beta-carotene that gives carrots their color makes the rice golden.

How did they do that?

Three genes were inserted—two from daffodils and one from a bacterium.

Why did they do that?

The answer depends on the “camp” you ask.

Biotech Camp:

- The rice can provide essential vitamins to poor people in underdeveloped countries. The restricted diet of many of these people can cause death and/or blindness, especially in Asia where many diets consist mainly of rice.

Anti-biotech Camp:

- Large companies can make farmers and poor people dependent on them. Sterile plants mean farmers cannot grow crops from plant seed the following years, and therefore must buy new rice seed from the companies.
- Golden Rice is a method of convincing people to accept genetic engineering. With acceptance, companies can then develop many other genetically modified plants from which they can make a profit, as well as own all the food crops.

Who are they?

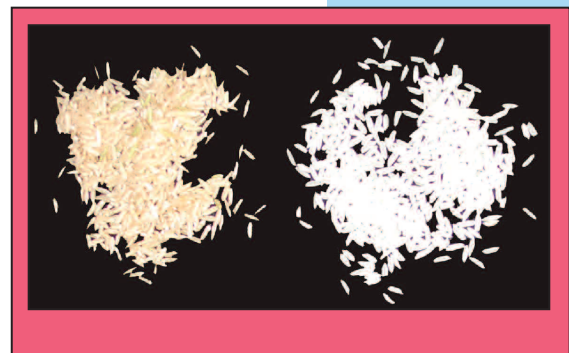
Professor Ingo Potrykus (Swiss Federal Institute of Technology, Zurich)

Dr. Peter Beyer (University of Freiburg, Germany)

“European Community Project was one of two sponsors of this project. The first sponsor was Rockefeller Foundation. Syngenta is the industrial partner in the European Community Project. According to the agreement the company Zeneca has exclusive rights to sell the seeds in the developed countries. But the Humanitarian Board got the license back from Zeneca to give it to developing countries free of cost. The only obligation on our part is that we use it for humanitarian purposes and not make any profit from it.”

- Dr. Peter Beyer, Can Golden Rice keep vitamin A deficiency at bay? *The Hindu*, November 2002 -

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Golden Statements

"If anyone tells you that GM is going to feed the world, tell them that it is not... To feed the world takes political and financial will – it's not about production and distribution."

- Steve Smith, former head of Novartis Seeds -

"Biotechnology and GM crops are taking us down a dangerous road, creating the classic conditions for hunger, poverty and even famine. Ownership and control concentrated in too few hands and a food supply based on too few varieties planted widely are the worst option for food security."

- Christian Aid Report: "Biotechnology and GMOs" -

"...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."

- Gordon Conway, President of the Rockefeller Foundation, the chief funder of the Golden Rice project -

"A single nutrient approach towards a nutrition-related public health problem is usually, with the exception of perhaps iodine or selenium deficiencies, neither feasible nor desirable."

- John R. Lupien, Director, Food and Nutrition Division, Food and Agricultural Organization, United Nations -

"Seeking a technological food fix for world hunger may be...the most commercially malevolent wild goose chase of the new century."

- Dr. Richard Horton, editor of the British science journal The Lancet -

"If it were not for the vast array of alternatives on offer, the arguments for the GM approach might be genuinely compelling."

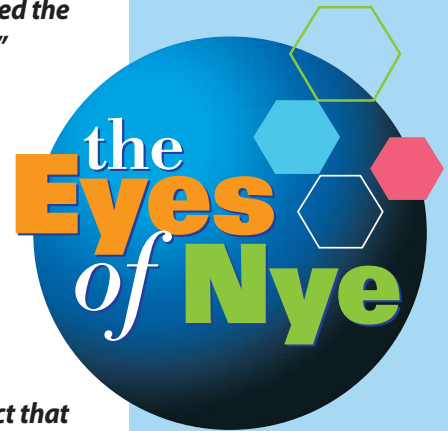
- Hugh Warwick, Splice, magazine of the Genetics Forum, March/April 2000 -

"Golden Rice hopefully helps to achieve better acceptance of GMO technology, to encourage scientists and granting agencies to invest also into projects with no a priori guaranteed success, to motivate public research to care more for the problem of food security and less for additional funds from industry, to encourage those who have rights in key enabling technology to make free licenses available for humanitarian projects, for some scientists to consider that there can be more in a scientific career than the chance for impact factor points, and to have some GMO opponents consider whether a differentiated discussion of the GMO technology might not be the better strategy in the long run."

- Professor Ingo Potrykus (Swiss Federal Institute of Technology, Zurich) -

Last statement made in The "Golden Rice" Tale, AgBioWorld. Other statements claimed by Friends of the Earth: The U.S. Voice of the World's Largest Network of Environmental Groups

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Something Old, Something New...

Something Old

We have known Bt toxins to be harmful for years...

Dozens of proteins, all Bt toxins, are produced by different strains of the soil bacterium *Bacillus thuringiensis*. Various reports have documented that bacterial spores of *B. thuringiensis*, containing a mixture of toxins have caused allergic reactions in farm workers. The protein Cry1Ac in particular has been found to produce genetic immunity in animals; cells in the small intestine in rats even have proteins that bind to it. Another Cry1Ab is 92% indigestible in pigs.

Data has shown Bt to be safe to humans and nontarget organisms...

We began to discover strains of Bt that were toxic to different insects over 20 years ago, and over 15 years ago we began to identify the genes responsible. These are the genes they succeeded in moving across species lines and into crops. The best indicator of the safety of a Bt transgenic crop is our experience with Bt itself. It's been used as a microbial pesticide for years. In 1998, in fact, the EPA compiled many years of data into a re-registration eligibility decision document (RED) that covers all Bt products not produced by genetic engineering. The data overwhelmingly supported the safety of Bt to humans and nontarget organisms. Also, though there are very few insecticides certified for organic agriculture, some Bt spray formulations are even among those.

Something New

C'mon, Bt crops are not even being regulated...

Our regulatory process has completely ignored the negative findings on Bt toxins. That is dangerous because Bt genes in crops undergo changes from the naturally occurring genes. Yet, when you test for toxicity you keep testing the natural toxins, not the toxin produced in the GM crop plants. How does that tell us what we want to know? So you have it: Bt toxins in GM crops are practically untested and therefore unknown.

Bt crops are given the same tests as every other chemical pesticide...

We consider Bt transgenic crops to be plant pesticides, and they are given the same tests that are administered to any chemical pesticide. If it looks like the U.S. Environmental Protection Agency (EPA) gives only a glance at the seed lines of transgenic plant producers before approving their commercialization, that is because we've been dealing with assessing the risk for nearly forty years of positive experiences with commercial Bt sprays.

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Something Borrowed

The GM toxin is not the same as the natural Bt toxin we know about...

Again, the natural toxin is not the same as or even “substantially equivalent” to the GM toxin. Green lacewings die or experience delayed development when they eat one insect pest we know of (lepidopteran) that has eaten GM maize containing the Bt toxin Cry1Ab, but not when they eat the same pest treated with much higher levels of the natural toxin. This effect is passed on through the food chain. And further, your researchers misrepresented data when they claimed that Cry1Ab does not harm beneficial insect predators.

The gene used is simply a truncated version of the natural gene...

The insecticidal gene that we moved into corn (cotton and potatoes as well) is actually a truncated version of the natural gene. We borrowed it. For the gene to function in plant cells, small snippets of DNA are attached that allow the code to be read; marker genes that encode for either antibiotic or herbicide resistance are spliced onto the toxic protein gene. We know what it does and does not do.

Something Blue

The Bt toxins won't hurt anyone...

The insecticidal proteins produced by the various strains of Bt are toxic only to certain species of insects—those that have the right physiology. All other organisms tolerate Bt exposure without any signs of injury. For people, and most animals in fact, the real “toxin” is in the dose. The rats you mentioned earlier? We’ve fed lab rats high doses of insecticidal proteins and found no measurable toxic effects. Actually, many common substances around the home (e.g., table salt, caffeine, vitamin A, and lawn herbicides) could cause illness at much lower doses than Bt proteins. How do we know you didn’t just feed them so much Bt that they didn’t have a chance? And as for effects from long-term exposure, when proteins are toxic, the effect is immediate (acute), never cumulative (chronic).

It is true that it *might* be argued that Bt sprays do not leave as much insecticidal protein as is present in a transgenic plant, in which every tissue makes large quantities of the protein. But we must remember that different amounts of the protein will be found in different tissues, and we should only calculate the part we eat. Take for instance the highest amount we’ve found in the edible portion of transgenic Bt corn. We know how much that is, and it varies widely—the amounts of Bt protein in various tissues of transgenic corn plants throughout the growing season have been measured and reported to the EPA. A two-year-old child would have to eat, for instance, 27 pounds of popcorn in order to reach the amount of toxin per unit of body weight that caused the lab rats to die. In other words, the EPA justifiably declared the risk of a toxic reaction from Bt proteins as “nil.” Trust us.

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Welcome to Shady Acres!

Independent Sunnyville County Farmer

You own your farmland and all of your crops, from the plants to the seeds they produce. It has all been in your family for generations. Your plot is not huge, but it's big enough...

When you heard that ModGrow Foods, Inc. was moving in, a number of thoughts crossed your mind. Would they try to buy your land also, like they did so many of your friends' lands? If so, would they pay enough? Now, that could get interesting...

Sunnyville is windy, and you've heard these new genetically engineered crops can crossbreed just like normal crops. You've driven the distance to ModGrow's land several times, wondering just how far away is "far enough." And, what happens if you save your seed next year like you always do, then find it was some of *their* seed? You know a farmer in another state that was sued by a big modern agriculture company for doing that just last year...

Anyway, can you even compete any more? These people get so many crops, and so fast! Maybe it's better that they do it—more people can have more food then. But, you wonder, for how long?

Shady Acres Resident

You saw some of their machinery arriving yesterday as you were driving back into town. And hey, who can argue with the lower prices everyone says we'll soon be seeing at the supermarket? You smile and wonder *how long* will they be lower? But no, that's no way to think...

You have two friends that have already gotten jobs there, and hundreds more are supposed to follow soon—that is good news. And the school is getting new computers and 12 new portable buildings. Better the industry tax base goes up and foots the bill than your own tax base...

You wonder how the food will taste! You heard it was fine, no different than any other food. Good thing. Turning your back yard into a mini-farm wasn't exactly what you had in mind this year...

ModGrow Foods, Inc. Scientist

Well, move in and set up is almost complete. You smile when you think of all the people who have been staring at you in the supermarket lately. Shady Acres isn't tiny, but they must not get a lot of new people very often. You hope it doesn't have something to do with people worrying about ModGrow...

You had a meeting earlier today about the containment plans. The bird issue should be

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taken care of—they won't get to crops to move seed, at least not this year. But this place is very windy—that's on the agenda next. It'll be done right. You'll see to it. Now if no one starts up with the labeling stuff, everything should be fine. You know they can't make you do that—they'd need approval from the FDA. But still, better if it just isn't mentioned. Add that unnecessary cost in and there goes all these folks'—and my—savings at the grocery counter, not to mention jobs lost...

At least there aren't many weeds out here—just great land. You read recently that the amount of herbicide sprayed had actually risen in the last couple years because crops like ModGrow's could withstand it. Now *that's* when there's too much of a good thing! Well, no such problem here...

