



Editorial

Is the battle over genetically modified foods finally over?

The Earth is finite, and as such has a limited capacity to produce the food and fresh water necessary to sustain human populations. With the size of the world's population, currently topping 6 billion people, including over 1 billion each in China and India alone, not only has the availability of natural resources become limiting, but also it has become increasingly difficult to feed this enormous population. Moreover, the world's population is expected to double in the next 50 years. Birth control awareness programs and government restrictions on the number of children a family can have has had a positive effect in decreasing the rate of population growth, especially in China. However, in many countries of the world, cultural and religious views on birth control are a major impediment to effective population control. As a result, many countries are faced with a population that is well beyond their carrying capacities. Many of the regions beset with uncontrolled population growth and/or the inability to feed a burgeoning population include developing countries in Africa, Asia, and Latin America.

One potential solution to address the problem of insufficient crop yields to support starving populations is the use of genetically modified (GM) foods. These GM foods are derived from crops that have been modified genetically to contain a desired trait such as drought or salt tolerance; insect, herbicide, or disease resistance; or increased nutritional content (Glick and Pasternak, 2003). GM plants have been touted to have the advantages of enhanced yield, decreased ecological footprint, and increased nutritional value (Uzogara, 2000). On the other hand, critics of GM plants argue that GM crops may disrupt the natural habitat of other plant and animal species in the environment. For example, it has been suggested that butterfly larvae that land on insect-resistant GM crops may ingest the insecticidal proteins from the plant and thus be negatively affected. Others have envisioned problems from cross-pollination and interbreeding between GM crops and weeds that may result in "superweeds" that have acquired the crop's resistance to herbicides (James, 2003; Snow et al., 2004).

The concerns about this technology notwithstanding, many countries have funded research on genetically engineered crops, and with each succeeding year since 1995, the number of countries, crops, and hectares of land devoted to GM crops has increased significantly. For example, between 2002 and 2003, there was a 15% increase in world

utilization and production of GM crops. China alone increased its acreage of transgenic crops by 25%, from 2.1 million ha in 2002 to 2.8 million ha in 2003, compared to a 9% increase by the U.S. from 2002 to 2003. More recently, China has intensified its involvement in the development and commercialization of genetically modified rice, prompted by 27% price increases for rice since the beginning of 2004, compared to the same time in the previous year (Jia, 2004). Rice, being the most important staple crop for more than half of the world's population, is primarily grown and consumed in Asia (Lu, 1996). Apart from the price increase, what further complicates the issue of sustaining China's population is a significant decrease in recent rice output. To meet its current and future needs for rice, the government of China announced that it is ramping up its efforts to commercialize genetically modified rice. From a research perspective, China has already developed several varieties of genetically modified rice that are resistant to that area's major pests, pathogens, and diseases. Moreover, China is expected to launch several additional new field trials for GM rice this year, with the total planted area of GM rice expected to be 53 ha. In addition, the U.S. regulatory authorities approved 12 field trials for GM rice, including over 45 ha, during the first quarter of 2004.

Commercialization of GM rice in China, at a competitive price for its population of approximately 1.2 billion people, would mean a virtually guaranteed market for this staple crop. India, being the second largest producer of rice in the world, is expected to soon follow suit with its own commercialization program of GM rice. Already, India grows GM cotton that has led to reduced pest populations and significant reductions in insecticide use (Thomson, 2002; Jayaraman, 2004). In addition, Indian scientists have engineered rice strains that resist local sucking pests. Quite recently, a consortium of seven Indian companies obtained licensing for genetically modified cotton, and hope to push for the commercialization of other GM crops such as rice (Bagla, 2004). This step would in effect be the "clincher" in the global debate over the use of GM foods. With the two largest rice producers in the world (representing approximately 35–40% of the world's population) switching over to GM rice in an effort to increase output and decrease crop losses due to disease and insect damage, the rest of the world will eventually have little choice but to accept GM foods as a significant component of modern agriculture. Japan recently sanctioned the commercial sale of allergy-fighting transgenic rice, expected to be generally available to the public by the year 2007 (<http://www.betterhumans.com>). The Japanese government has funded a major collaborative project into laboratory and field trials of a transgenic rice variety that has been developed to fight hay fever and has promised (provided that the tests go as expected) commercial availability of the product by 2007 (Anonymous, 2003).

While many of the countries that have been active in the commercialization of GM crops are not involved in the production of GM rice, in the past few years, they have nevertheless produced and commercialized a number of other important crops including corn, cotton, canola, and soybean. Moreover, every year for the past 7 years, there has been an increase in both the total number of hectares of GM crops planted, as well as the number of countries involved in planting GM crops (James, 2003).

The strongest opposition to GM foods has come from Europe, which, on a global scale, does not happen to be a large rice importer. Therefore, it is likely that GM rice will face little opposition from environmental activists in Europe, especially with the backing of the

Food and Agriculture Organization (FAO) of the United Nations, which recently endorsed the use of genetically modified crops ([Nature Biotechnology, 2002](#)). Additionally, it is worth remembering the case, in the summer of 2002, when six starving African nations afflicted by drought, refused U.S. food aid for fear that the European Union would boycott their local exports, after the corn that was sent for distribution had been found to be genetically modified. The refusal came after the European Union threatened to ban agricultural imports from Africa because of fears that they may have become contaminated with the transgenic corn from the U.S. that was sent as food aid. As a result, millions of people in Africa faced possible starvation and subsequent death ([Nature Biotechnology, 2002](#)). To prevent this kind of disaster, it is imperative to take steps to allay prejudices and concerns over genetically modified foods. This can only be accomplished through education, and open and informed public discussion of research on GM crops.

According to Dr. Florence Wambugu, President of Harvest Biotech Foundation International in Nairobi, Kenya, "The African continent urgently needs agricultural biotechnology, including transgenic crops, in order to improve food production" ([Wambugu, 2003](#)). Famine provides critics with an opportunity to promote an anti-biotech message that only results in millions of people, who urgently need food, starving to death. She urges the public to recognize the difference in needs between Europe and Africa. Europe, with a population that is under control, has surplus food and does not experience hunger, whereas Africa, in contrast, experiences mass starvation and death ([Wambugu, 2003](#)). New biotechnological advances could have significant impacts not only on yields of crops, but also on the morale of farmers who toil hard to reap a fruitful harvest. She further argues that it is necessary to set up knowledgeable regulatory bodies that set policies to ensure that multinational biotechnological companies do not exploit the potential economic wealth of Africa. She suggests that the emphasis should be on educating local farmers about GM technology, and providing them with the resources necessary to implement this technology in an effort to enable Africa to become more self-sufficient in food production.

Once GM rice is commercialized, it is highly likely that other crops will soon follow. Thus, the impact of the current initiative by China is that it will, in all likelihood, act as a catalyst to alter some of the perspectives and biases against GM foods. Embracing GM foods globally would mean alleviating existing starvation and malnutrition, especially in many of the poorer countries of the world where the majority of the populations are malnourished. For example, Africa has the lowest crop productivity in the world, mainly due to poor soil quality and insufficient resources that pertain to basic agriculture ([Thomson, 2002](#)). Implementation of GM crops in developing nations of Africa would mean more independence from fertilizers and irrigation, factors that are not readily available to farmers in the Sub-Saharan desert. Apart from the obvious advantages of GM plants such as insect and drought tolerance, pathogen resistance, added nutritional value and improved yield, oral vaccines could also be incorporated into GM plants in an effort to increase the availability of immunizations in some of the most impoverished and disease-prone areas of the world ([Glick and Pasternak, 2003](#)). Of course, GM foods can provide only a short term solution to food shortages due to over population, if population growth continues to increase as it has.

The advent of transgenic crop biotechnology and its implementation into fields has already had a tremendous impact on global food security. To date, 18 countries in total have implemented GM crop technology for a total of 67.7 million ha of land growing transgenic crops that are either herbicide resistant, insect resistant, or both (ISAAA, 2004). With China forging ahead with the largest annual increase in acreage for transgenic crops for two consecutive years, and India following suit to commercialize and implement its own variety of GM rice, it is inevitable that the battle over genetically modified foods is coming to an end. The day of stocking grocery shelves worldwide with “GM” foods does not seem so far away.

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