GMOs and Global Food Security

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A PATH FORWARD:

Genetically Modified (GM) foods and crops are a key tool in helping to address the challenge of feeding a growing and more prosperous population, and improving the global standard of living today and for future generations. The high costs and uncertainty about the regulation of GMOs have slowed the rate of innovation of new traits and prevented startups and major companies from developing many second-generation varieties that could improve our well-being, enhance environmental sustainability and make a major contribution to addressing the challenges of climate change.

- The use of GMOs can ease land and water competition issues and limit greenhouse gas emissions.
- Food security and human well-being will be enhanced if the regulatory environment supports development of second-generation technologies.
- Wise public policy and regulations will encourage scientific advancement and innovation to avoid ongoing food insecurity and food crises as the world population grows.
- Agriculture policy should encourage technologies that help farmers produce food more sustainably, using fewer resources.

THE CHALLENGE AHEAD

At the turn of the 21st century, global agriculture faced immense challenges. Population would increase from seven to nine, or even eleven billion people in coming decades, with growing average incomes. This meant we would need to increase current food production by 60 percent or more. Climate change would place a heavy toll on agricultural productivity in many regions and we would need to reallocate and change our crop production patterns. To control greenhouse gas emissions we would need to transition away from an economy dependent on nonrenewable fuels to a sustainable economy relying on renewable resources. This would entail increased reliance on plants as feedstock for fuels and chemicals. Humanity would have to rely on existing or even dwindling resources of land and water, to more than double the productivity of agricultural and forest products in a manner that would be environmentally sustainable and economically viable. These are daunting tasks but if we take advantage of developments in science and establish wise policies and regulation, we will be able to accomplish them.

Humanity’s past indicates that we are up to the challenge. From 1800 to the present, human population has skyrocketed seven fold but agricultural productivity has grown even faster. In the last 200 years, as agriculture

increased its reliance on science, the average human effort to produce food declined. These achievements reflected better understanding of the principles of science that allowed for the improvement of crop breeding, fertilization and pest control, innovations in irrigation and cultivation and smarter management practices. This transition was far from perfect; it was associated with negative environmental side effects and did not solve many problems, including persistent poverty. But human societies are able to adapt, identify failures and learn from mistakes to develop improved solutions.

The discovery of the genetic code and DNA in the 1950s is perhaps the greatest scientific achievement of the 20th century. While the basic understanding of the atom in the 19th century and early 20th century filled the knowledge gap for the Electronic Age, the discovery of DNA has the potential to lead to a biology-based revolution in the 21st century. Tools based on modern advances in molecular biology that take advantage of our ability to understand the functions of genetic traits have already been used extensively to develop genetically modified products in medicines.

Medical biotechnology has been embraced wholeheartedly for its achievements and potential. Parallel scientific and technological breakthroughs occurred in agriculture, unleashing effective solutions that have increased productivity and improved the environmental performance of agriculture while identifying challenges that loom ahead. But the advancement of agricultural biotechnology has been hampered by controversy and excessive regulation.

GMOs PROVIDE A PATH FORWARD

A major application of agricultural biotechnology is genetically modified organisms (GMOs) in which a gene that contains certain traits is inserted into crops to improve performance. Crop improvements in the past always occurred via changes in genetics but with traditional plant breeding, we did not actually know the changes in the genomic level because the only thing we observed were the outcomes. Genetic engineering allows for more precision, in which only a few genes are altered within a plant that has thousands or even tens of thousands of genes.

Genetic engineering in agriculture is in its infancy, the first-generation commercially utilized traits are mostly used to control pest and plant disease. Scientists have discovered, and tested in the field, multiple second-generation varieties that improve plant nutrition and resilience, and a third-generation of traits that can produce valuable products, including medicine and fine chemicals that are in early stages of development.

Despite heavy restrictions, first-generation GMOs have made an immense difference. Pest control varieties have been adopted in the U.S., Canada, Brazil, Argentina and to some extent South Africa, utilizing corn, soybean, rapeseed and papaya. Most of the cotton production in India and China relies on GMOs, and GM cotton is intensively used in other developing countries. All told there are GM applications in 28 countries covering approximately 400 million acres worldwide, or about 1.5 times U.S. farmland.

However, GM seeds are practically banned in Europe and much of Africa, and are not used in growing some major crops such as rice, wheat, potatoes, and most fruits and vegetables. Despite the fact that only 25 percent of corn inthe world is grown with GMOs, the use of the technology has led to an increase in the availability of corn estimatedat 10 percent; soybean of around 20 percent; and for cotton around 18 percent. These increases have resulted fromboth higher yields per acre that can reach 40 percent in cotton and 30 percent in corn, as well as allowing forexpansion of land and/or seasons for growing for certain crops. For example, the introduction of GM soybeanallowed for double-cropping of soybean in Argentina and Brazil, where the same land was used to grow wheat.

These increases in the supply of corn and soybean in particular have allowed developing countries, particularly in Asia and Latin America, to meet the drastic increase in the demand for meats from the rising middle class. The increase in the supply of soybean in Argentina was slightly bigger than the increase in demand for soybean for meat production in China. Because small shortages in food availability lead to drastic increases in prices of food that harm mostly the poor, GMO has already made a significant positive contribution to human well-being. For example, without GMOs the price of soybean would be around 33 percent higher and about 13 percent higher for corn. These increases played a role in preventing the food crises and riots of 2008 and 2011 from becoming a global phenomenon. Without GM, the shortages that occurred during these periods were smaller than the amounts provided by GM; without GM crops, we could experience similar crises in the years ahead.

GM crops have also shown to substantially improve the day to day life of farmers. The adoption of GMO in cotton in China and India increased farmers' yields and the market share of these countries in the global cotton market. There is evidence that it reduced incidences of disease and death from exposure to pesticides and in some cases doubled the income of subsistence farmers while reducing the workload of mostly women and children who do the weeding. There is also recent evidence that low-income farmers in South Africa who recently embraced GMO corn also have benefitted financially, improving their quality of life.

There are sustainability benefits as well. Because GMO increases the productivity of land, it reduces the amount of land we need to farm and the use of chemicals, water, energy, and greenhouse gas (GHG) emissions from agriculture needed to produce a certain volume of food.

CHALLENGE OF POLITICAL AND SOCIAL OBJECTIONS

While there have been expressed concerns about human health and the environmental side effect of GMOs, the National Academy of Sciences, American Association for the Advancement of Science, the World Health Organization, the Royal Society of Medicine, among dozens of major independent science organizations, have found no evidence that they are less safe than conventional or organic foods, and in some cases may be safer and more sustainable. There have been more than 2000 studies that have examined the health and environment effects of GMOs and none has documented reliably any significant negative effects.

That said, we need to continuously evaluate our food production systems, both conventional and organic, andsupport appropriate regulatory systems to assure their quality and independence. Despite overwhelming evidence onthe benefits of GMOs, political and commercial interests, especially in Europe, have led to growing and import bansin some places in Europe and stifling regulations in much of the rest of the world. These regulations expressconcerns about possible risks, not documented problems, but they have real and significant costs.

If the European Union and Africa had adopted GMO corn at the same rate as the U.S. and Canada, large amounts of land would have been saved, reducing GHG emissions and the prices of food to the benefit of the poor. Adoption of GM corn, rice and potatoes would have freed agricultural land for other activities and improved food security globally. The high costs and especially the uncertainty about regulation of GMOs have slowed the rate of innovation of traits and stunted the development of many second-generation varieties that could have improved human well-being, enhanced environmental sustainability and made a major contribution toward addressing the challenges of climate change.

Golden Rice is a striking case of a lost or delayed opportunity. It's a rice variety enriched with beta-carotene, a precursor to Vitamin A. Every year, an estimated quarter million people who rely on rice for their diet go blind due to lack of Vitamin A. Many of them die. A variety of Golden Rice was first available around 2002. Over time it has been improved but regulatory pressure has prevented its introduction. It has been estimated that even a limited adoption of Golden Rice could have saved millions of people from blindness and death due to Vitamin A deficiency.

Most of the foods we now consume are modified. In thousands of years, farmers and societies have developed varieties of corn, rice and potatoes that are totally different from their ancestors. That's allowed us to utilize our resources much more effectively. Genetic engineering helps us understand how to breed, and how to do it more precisely and in a more sustainable manner. While fears of new technologies are understandable, the exaggerated anxiety of the few should not prevent the many from reaping the proven and safe benefits of science.

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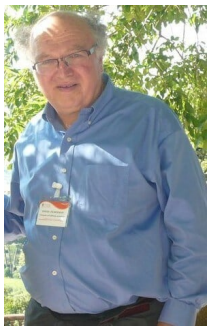

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