

The Future of Farming and Rise of Biotechnology

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Today, more than 800 million people are malnourished, meaning they do not get the minimum energy requirements set by the United Nations Food and Agriculture Organization (FAO) of 1,690 calories per day for an urban adult and 1,650 calories for a rural dweller.¹



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The world's population is projected to grow by 2.3 billion people from 2009 to 2050, to 9.1 billion. To feed that many people adequately will require a 70 percent increase in food production globally and a doubling of food production in developing countries.²

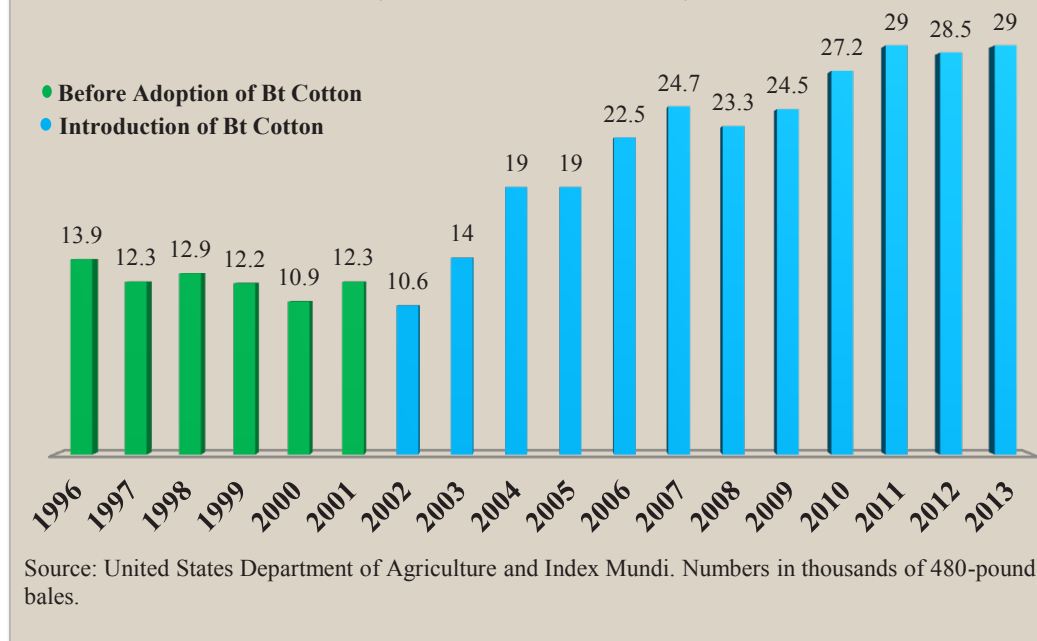
There are natural limits to the productivity increases that can be obtained with conventional farming. Scientifically advanced biotechnology could greatly benefit the world's growing population, but governments have placed severe regulatory restrictions on the use of such technology. The most controversial aspect of biotechnology is the development of genetically modified organisms (GMOs) to increase crop yields per acre and to improve the nutritional quality of the food produced. Restrictions on the development and cultivation of biotech crops have slowed global progress in conquering hunger. Through advanced research and new farming methods, global hunger could be reduced.

The Problem of Global Hunger. Every year, U.N. agencies gather to discuss the continuing hunger crisis.³ By utilizing existing programs, the U.N. hopes to achieve a lasting balance between the food supply and the nutritional demands of a growing population, but the plans proposed to achieve this balance vary widely.⁴ Furthermore, there is a persistent drive to increase conventional farming rather than to utilize biotechnology.

Essentially, biotechnology improves the characteristics and requirements of food crops through manipulation of plant DNA, or genetic engineering, creating a GMO. Such plants have better insect resistance and herbicide tolerance, and the sustainability of cultivation is increased by minimizing use of pesticides and fertilizers.⁵ A common way this is done is by introducing genes from the *Bacillus thuringiensis* (Bt) bacterium.⁶ Though additional productivity increases could be achieved through conventional farming, such as more widespread use of chemical fertilizers, biotechnology is essential. Rather than discourage the growth of biotech crops, the U.N. should promote their development and use.

Multinational organizations, such as the European Union, should ease restrictions on the importation, planting and sale of GMOs. On June 12, 2014, the European Council moved to allow Member States to restrict or ban the cultivation of EU-authorized GMOs within their own territory.

Figure I
Cotton Production in India
(thousands of bales)



9.4 million hectares.⁹ (A hectare is equivalent to a little more than 2 acres.)

To calculate yields, scientists conducted a survey of how much is grown in a sample area. [See Figure I.] On one cotton farm, the yield increased 7,625.7 pounds per hectare while reducing the costs by \$143.32 per hectare through less use of pesticides.¹⁰ This increase in production is raising the incomes of cotton farmers and farm laborers, and it is allowing many farmers to invest in upgrading their machinery.¹¹ The majority of small independent cotton farmers in India rely on cotton as a cash crop, and they buy food locally with the revenue earned from their crops. Thus, Bt cotton has not only increased yields beyond

No GMO can be cultivated within the EU without prior authorization and risk assessment from national evaluation agencies, the European Food Safety Authority and approval from the Member State in which it will be cultivated.⁷

It has been claimed that biotech crops are more expensive than conventional crops and do not improve yields, but evidence from around the globe shows the opposite is true.

Biotech Cotton in India. As India's population has continued to increase beyond the number that can be fed by traditional agriculture, the adoption of biotech crops has grown. A study conducted from 2002-2008 sought to determine the yield advantages of biotechnology crops. Of 533 cotton farms examined in the study, 38 percent had adopted Bollgard Bt cotton in 2002, a strain of Bt cotton developed by Monsanto, a major biotechnology company. By the end of the study in 2008, 99 percent of the sample households had adopted Bt cotton.⁸

Bt cotton is able to ward off insects and pests without additional pesticides. Reducing the need for pesticides minimizes environmental damage while increasing agricultural yields. Initially, 290,000 hectares were planted with Bt cotton. By 2012, that number had reached

the capability of conventional farming, it has also created a more technologically advanced agricultural economy in India.

Biotech Sugarcane in Brazil. Brazil produces roughly 588 million tons of sugarcane per year, nearly half of the world's output. It has the potential to double the amount produced to roughly 1.176 billion tons.¹² However, it is estimated that Brazilians lose more than half of their potential yield to drought, pests and weeds. These losses have encouraged the widespread adoption of biotechnology in Brazil.

Brazil is the world's number two producer of genetically modified crops, after the United States. As with corn in the United States, sugarcane in Brazil is used as food as well as an energy source. Transportation biofuels are so cheap in Brazil that sugarcane ethanol is downgrading gasoline to an alternative fuel.¹³ As the world's population increases, so does the need for energy.

The move to biotechnology crops in Brazil began in the early 1990s when researchers began experimenting with soybeans due to their widespread use. However, until March 2003, a government ban prevented the use of GMOs. Lifting the ban has allowed Monsanto, which

spends \$1.5 billion annually on research worldwide, to conduct biotechnology research in Brazil.¹⁴

In 2009, Brazil created and approved for use a new strain of sugarcane projected to increase average annual yields by 20 tons per hectare.¹⁵ By 2020, annual projected demand for sugar will increase 13.7 million tons. With biotechnology, Brazil is getting closer to meeting that demand.¹⁶ [See Figure II.]

Biotech Corn in the United States. While countries around the world are slowly gaining access to biotech crops, the United States has revolutionized the industry. One of the most well-known biotech crops in the world is corn. Corn, like sugarcane, has multiple uses. Many countries around the world use it for ethanol, food and even bioplastics.¹⁷ With such a wide variety of uses, corn quickly became the most desired crop for biotech research.

More than any other crop, corn has significant research potential. In the United States there are several varieties of Bt corn that have been genetically engineered to resist herbicides and pests and even withstand drought. Further research could include salinity immunity, which would allow corn and other crops to be planted in soil which would otherwise be unable to sustain agricultural life. These advances are especially useful in developing countries seeking locally sustainable farming.

Nearly 20 percent of all U.S. corn and 50 percent of all U.S. soybeans are exported to other nations, yet it is still not enough to feed the world population. Furthermore, there are many regions in the world in addition to the European Union that do not allow the production or importation of biotech crops, greatly reducing both the amount of food and technology that can be transferred internationally.

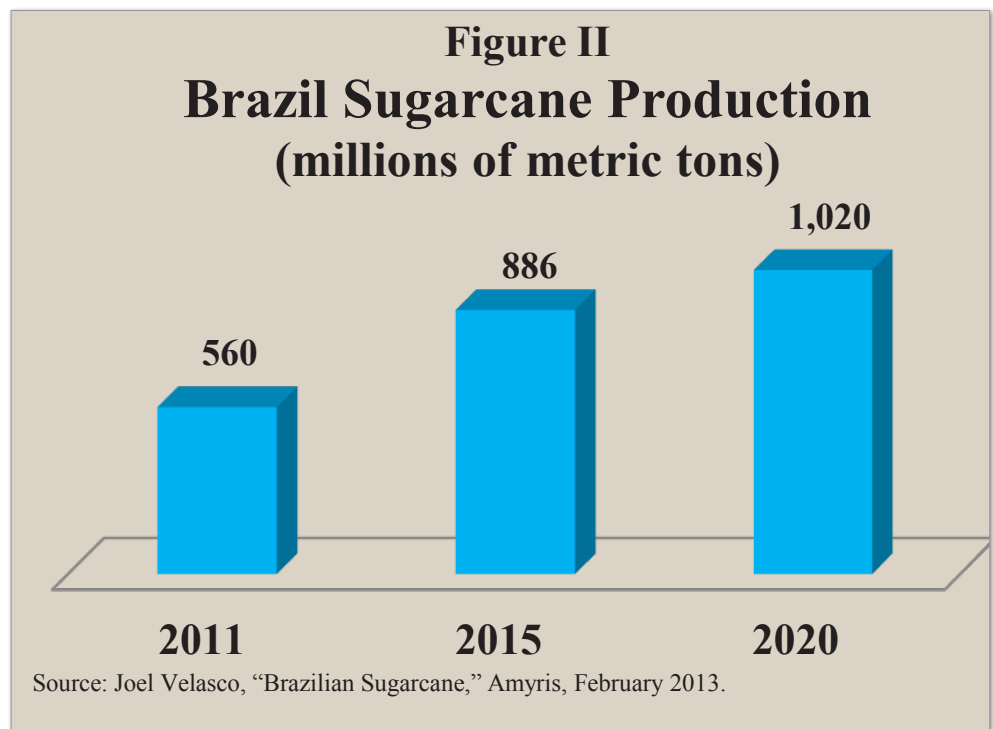
Meanwhile, 88 percent of corn grown in the United States has been altered utilizing biotechnology.¹⁸ This has propelled production to numbers never thought possible, allowing the United States to remain the global leader in corn production. But the world economy is currently unable

to take full advantage of biotechnology. With decreased regulation, however, the ability to feed the world would be easily attainable.

Conclusion. Global hunger will only continue to increase and combating it will not be easy, yet the world is fortunate in that a wealth of research is dedicated to the advancement of farming. For instance, Nobel Prize winner Norman Borlaug was recognized for surpassing technological limits and pushed the boundaries of conventional farming through the use of biotechnology. Borlaug did so by breeding crops with desirable characteristics in an era when it was not possible to directly manipulate DNA. His research alone is credited for saving nearly a billion lives, and he was applauded by President Barack Obama for his dedication to feeding the world.¹⁹

Placing limits on biotechnology restricts the advancements that Borlaug pioneered and only hurts the world's starving population. Interest groups will continue to combat the use and production of GMOs, but science will continue to dominate the industry. Through advanced research and new farming methods, hunger can be fought and conquered.

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Notes

1. Food and Agricultural Organization, "FAO Methodology for the measurement of food deprivation," October 2008. Available at http://www.fao.org/fileadmin/templates/ess/documents/food_security_statistics/metadata/undernourishment_methodology.pdf.
2. Population Institute, "FAO says Food Production must Rise by 70%," 2013. Available at <http://www.populationinstitute.org/resources/populationonline/issue/1/8/>.
3. Food and Agricultural Organization, "The State of Food Insecurity in the World," 2013. Available at <http://www.fao.org/publications/sofi/en/>.
4. United Nations Environmental Programme, "Food Waste Facts," 2013. Available at <http://www.unep.org/wed/2013/quickfacts/>.
5. Biotechnology Industry Organization, "What is Biotechnology?" 2013. Available at <http://www.bio.org/node/517>.
6. "Bacillus thuringiensis, FAQs," University of California San Diego. Available at <http://www.bt.ucsd.edu/overview.html>.
7. European Commission, "New EU Approach," June 2014. Available at http://ec.europa.eu/food/plant/gmo/legislation/future_rules_en.htm.
8. Matin Quaim and Shahzad Kouser, "Genetically Modified Crops and Food Security," PLOS One, June 5, 2013. Available at <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0064879>.
9. Swaminathan S. Anklesaria Aiyar, "Higher yields & farmer preferences show, Bt cotton detractors spreading patent falsehoods," *India Economic Times*, January 30, 2013. Available at http://articles.economictimes.indiatimes.com/2013-01-30/news/36636091_1_bt-cotton-bt-variety-cotton-yields.
10. Monsanto, "India Cotton Success." Available at <http://www.monsanto.com/improvingagriculture/pages/celebrating-bollgard-cotton-india.aspx>.
11. Lemken, "Cotton farmers investing," 2012. Available at <http://lemken.in/nc/news-press/lemken-news/detail-view-lemken-news/article/cotton-farmers-investing-the-economic-times/>.
12. "Frequently Asked Questions," Sugarcane.org, 2013. Available at <http://sugarcane.org/media-center/faqs>.
13. "Brazilian Transport Fleet," Sugarcane.org, 2013. Available at <http://sugarcane.org/the-brazilian-experience/brazilian-transportation-fleet>.
14. Monsanto, "Corporate Profile," 2013. Available at <http://www.monsanto.com/investors/pages/corporate-profile.aspx>.
15. GMO Compass, "Brazil: GM sugar cane with a 25 percent yield increase expected in 10 years," August 4, 2009. Available at http://www.gmo-compass.org/eng/news/456.brazil_gm_sugar_cane_yield_increase_expected.html.
16. Joel Velasco, "Brazilian Sugarcane," Amyris, February 2013. Available at <http://www.eia.gov/biofuels/workshop/presentations/2013/pdf/presentation-08-020113.pdf>.
17. Nebraska Corn Board, "Corn Production and Uses." Available at <http://www.nebraskacorn.org/corn-production-uses/>.
18. National Corn Growers Association, "World of Corn. Unlimited Possibilities," 2013. Available at <http://www.ncga.com/upload/files/documents/pdf/WOC%202013.pdf>.
19. Christopher Doering, "Green Fields: Obama praises Borlaug," *Des Moines Register*, April 19, 2014. Available at <http://www.desmoinesregister.com/story/money/agriculture/green-fields/2014/04/19/obama-praises-borlaug/7901695/>.

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