The Future of Farming and Rise of Biotechnology

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

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 thuringensis (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.
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.\textsuperscript{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.\textsuperscript{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 9.4 million hectares.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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 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.\textsuperscript{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.\textsuperscript{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
c conducive biotechnology research in Brazil.\textsuperscript{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.\textsuperscript{15} By 2020, annual projected
demand for sugar will increase 13.7 million tons. With
biotechnology, Brazil is getting closer to meeting that
demand.\textsuperscript{16} [See Figure II.]

\textbf{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.\textsuperscript{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.\textsuperscript{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.

\textbf{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.\textsuperscript{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.

David Weisser is a research associate with the National
Center for Policy Analysis.

![Figure II](https://example.com/figure_ii.png)

\textbf{Brazil Sugarcane Production
(millions of metric tons)}

<table>
<thead>
<tr>
<th>Year</th>
<th>Production</th>
</tr>
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<tbody>
<tr>
<td>2011</td>
<td>560</td>
</tr>
<tr>
<td>2015</td>
<td>886</td>
</tr>
<tr>
<td>2020</td>
<td>1,020</td>
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Notes


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