

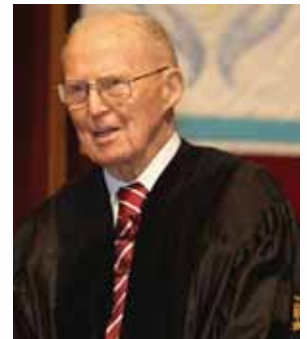
# FEEDING THE WORLD IN 2050

*GMOs, high-intensity farming and irradiation will have to be reckoned with if we are to feed nine to 10 billion people in 40 years.*

**BY JIM PREVOR**  
**EDITOR-IN-CHIEF**

“Some of the environmental lobbyists of the Western nations are the salt of the earth, but many of them are elitists. They’ve never experienced the physical sensation of hunger. They do their lobbying from comfortable office suites in Washington or Brussels. If they lived just one month amid the misery of the developing world, as I have for fifty years, they’d be crying out for tractors and fertilizer and irrigation canals and be outraged that fashionable elitists back home were trying to deny them these things.”

— *Norman Borlaug, speaking in reaction to the campaign by Greenpeace and other environmental lobbyists to get Western countries to restrict exports of fertilizer to Africa and to get African countries to reject food aid that was genetically engineered.*



Dr. Norman Borlaug

**O**n September 12, 2009 Norman Borlaug passed away. When he received the Nobel Peace Prize in 1970, it was estimated that he had already saved the lives of one billion people. He not only won the Nobel Peace Prize but also the Presidential Medal of Freedom and the Congressional Gold Medal. He is one of only a handful of people to win all three honors. He is the only man in history to win all three honors plus India's highest civilian honor that can be won by a foreigner, the Padma Vibhushan.

His biography is simple. Born in Iowa, the great-grandchild of Norwegian immigrants, Borlaug was raised on a farm with his three younger sisters. He went to a one-room school house through eighth grade and was inspired by his grandfather, who encouraged education, and his wrestling coach, who taught him to never quit and always give one's full effort to things.

He eventually received a Ph.D. in plant pathology and genetics from the University of Minnesota and, after working at DuPont assisting the war effort during World War II, he ultimately was brought down to Mexico by the Rockefeller Foundation. He first

worked leading research at the Cooperative Wheat Research Production Program and after 20 years, came to direct the International Wheat Improvement Program part of the newly formed Consultative Group on International Agricultural Research's International Maize and Wheat Improvement Center, or the *Centro Internacional de Mejoramiento de Maíz y Trigo* in Spanish. The center came to be known worldwide by its Spanish Initials, CIMMYT. It was established by the Rockefeller and

Ford Foundations in cooperation with the Mexican government.

Dr. Borlaug developed hybrid wheat that yielded much better than previously existing strains. It was disease-resistant and semi-dwarf to prevent collapse under the weight of a tall stalk. The hybrid varieties, however, required significant fertilizer and, often, irrigation to sate the plant during its rapid growth. It was this combination of high-yield hybrid varieties with substantial inputs such as fertilizers and

"I now say that the world has the technology – either available or well advanced in the research pipeline – to feed on a sustainable basis a population of 10 billion people. The more pertinent question today is whether farmers and ranchers will be permitted to use this new technology? While the affluent nations can certainly afford to adopt ultra low-risk positions, and pay more for food produced by the so-called "organic" methods, the one billion chronically undernourished people of the low income, food-deficit nations cannot."

— 30th Anniversary Lecture, The Norwegian Nobel Institute, Oslo, September 8, 2000

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irrigation that became what we know, today, as the "Green Revolution."

After helping Mexico to become self-sufficient in grains, Dr. Borlaug went off to Pakistan and India. He met great resistance. He was urging wheat on cultures that ate lentils and other items. He was disrupting set patterns of a set rural society and culture. Business monopolies, set up in the socialist milieu following the countries' independence from Britain, resisted anything that might disrupt their settled practices. In fact, he might have failed, except severe famine and war between India and Pakistan in the same year, in 1965, led to reconsideration, which allowed Dr. Borlaug to circumvent many laws and societal strictures. The results were phenomenal. As Gregg Easterbrook wrote in *The Atlantic Monthly* in 1997:

*By 1968, Pakistan was self-sufficient in wheat production. India required only a few years longer. Paul Ehrlich had written in The Population Bomb (1968) that it was "a fantasy" that India would "ever" feed itself. By 1974, India was self-sufficient in the production of all cereals. Pakistan progressed from harvesting 3.4 million tons of wheat annually when Borlaug arrived to*

*around 18 million today, India from 11 million tons to 60 million. In both nations, food production since the 1960s has increased faster than the rate of population growth. Briefly, in the mid-1980s, India even entered the world export market for grains.*

It was Dr. Borlaug's work that led to the development of high-yield, semi-dwarf rice cultivars in China and thus, brought the Green

Revolution to East Asia.

However, by the 1980s, when Dr. Borlaug then looked to bring the Green Revolution to Africa, the culture had shifted. Environmental groups pressured the Ford Foundation, the Rockefeller Foundation, Western governments and the World Bank to deny Dr. Borlaug funding. They were mostly successful.

Ryoichi Sasakawa, a Japanese national who established the Sasakawa Peace Foundation

"For fifty-two years, Dr. Norman Borlaug has been helping to provide more food to the most needy areas of the world. But perhaps of greater importance, this distinguished scientist-philosopher has been demonstrating practical ways to give people of the entire world a higher quality of life ... The passion that drives Dr. Borlaug's life is an inspiration for all of us to follow. Since 1986, we've worked together through Global 2000 of The Carter Center and the Sasakawa Africa Association to help small-scale farmers to improve agricultural productivity and crop quality, sometimes two or even threefold. It has been an honor to collaborate with Dr. Borlaug. He is a true humanitarian and a dear friend."

— Jimmy Carter, 39th president of the United States and 2002 Nobel Peace Prize Laureate

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and worked with Jimmy Carter after he was defeated for reelection to help agriculture in Africa, encouraged the semi-retired Dr. Borlaug to begin working in Africa. But the effort, continuing after Dr. Borlaug's demise, is chronically underfunded.

The opposition to expanding the Green Revolution to Africa is an attitude that can be seen as either anti-scientific or elitist, or both. It can also be seen as irrational. After all, when Zambia announced, in 2002, that it would reject thousands of tons of corn because of the likelihood it would contain some genetically-modified organisms, it was rejecting aid sent to solve an acute problem – people dying of malnutrition – because of a hypothetical risk so small that the American population ate the same corn.

The United States is a wealthy country and so it produces and exports a full range of food. One can get certified organic product, transitional product, hormone-free, non-GMO, ad infinitum.

The future of American agriculture though, does not lie in going back to the way things were grown a hundred years ago. Those artisan products are something special and part of our heritage. The future for America is the use of science to increase yields and enhance the products.

How could it be otherwise? The population of the world continues to increase and thus, the necessity of growing more food increases. When it is said that Dr. Borlaug saved more than a billion lives, it means he saved more than a billion people from starvation.

Our challenge is to feed the two to three billion people estimated to be added to the world population by 2050. Indeed, one's attitude toward technology in the food production and distribution system is to no small extent determined by what issue one is thinking of when approaching the question. If one is focused on improving the lives of relatively wealthy people in the west, well, the evidence still isn't strong, but one can at least discuss things like organic, locally grown, etc. If, however, one is focused on feeding a few billion more people, only the use of advanced technology seems likely to make that possible.

**THREE AREAS ARE PARTICULARLY IMPORTANT: Hybridization/Genetically Engineered Foods**

This is building on Dr. Borlaug's work. Reading the description of his efforts, one is overwhelmed with the tedium of it: Thousands upon thousands of cross-breeds being done

manually. Increasing yield through genetic engineering is still difficult. There doesn't seem to be one gene for "yield," and so our knowledge still has to advance to make this happen. But we can engineer pest resistance, drought resistance, nutritional enhancement and much more.

Although there are political issues in many countries with genetically engineered foods, farmers are pushing back because they need these tools to be successful. Presumably, as the years go by and Americans, who eat a lot

of genetically modified organisms, don't become pale or sick, other places will come around. China seems to be going full bore so if both the biggest economy in the world and the most populous nation in the world are eating genetically engineered foods, many countries will follow.

**Input-Intensive Agriculture/ Inorganic Fertilizer**

There is nothing wrong with organic agriculture, but yields tend to be lower, especially

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averaged over many years as organic agriculture may call for fields to remain fallow more frequently than conventional agriculture.

Although Integrated Pest Management is a valuable technique for minimizing pesticide use and thus costs, the need for pesticides still remains.

Equally, although organic fertilizers can be used, the scale on which they would be needed to grow all food organically simply isn't available. And even if chemical inputs can be minimized, other inputs, such as irrigation systems, are becoming more intense. The use of drip irrigation technology, for example, is becoming more important in an effort to avoid water evaporation.

Organic and local are a niche, but for the foreseeable future the big growth in production will come from input-intensive conventional agriculture.

### Irradiation

Food safety has dominated headlines in recent years, but the conversation has been surrealistic. Extensive efforts have been made and proposed in order to obtain tiny incremental improvements in safety.

We have, however, a technology – irradiation — that can significantly increase food safety at very little cost.

It is not clear why products such as hamburger or leafy greens should not be irradiated. The best explanation is either ignorance – fear that people will glow in the dark — or the kind of elitist attitude that Dr. Borlaug

**“Dr. Norman Borlaug is the first person in history to save a billion human lives. But he must also get credit for saving the wild creatures and diverse plant species on 12 million square miles of global forest that would long since have been plowed down without the high-yield farming he pioneered. The two accomplishments combined make him dramatically unique. I am proud to work with the Center for Global Food Issues, of which he is Chairman Emeritus.”**

— Senator Rudy Boschwitz, R-MN, former member of the US Senate Agriculture Committee



alludes to in the quote at the start of this essay.

Sure, if money is no object you can always demand bigger buffer zones and more intense food safety plans. If, like most people, money actually matters, then we need economical food, which means that it won't be grown and prepared in such a rarified way – say like bell pepper growing in a “clean room” – that safety can be guaranteed. So, the prudent thing to do is irradiate anything risky to avoid any possible death or serious illness.

Right now, very little food is irradiated in the United States. Some spices, some beef and a few random items. Some items, such as Hawaiian papayas, may be irradiated but only with a very low dose capable of killing pests, not pathogens.

We can expect, however, that more and more products will be irradiated, and this will actually help international trade as it will enhance food safety. Yes, it will require rationality to triumph over fear and superstition, but that is what Dr. Borlaug's work was really all about.

Beyond these three technologies, there are two issues that are raised by Dr. Borlaug's work and the resistance to it in modern times.

First, there is the environmental argument. The resistance to bringing high intensity agriculture to Africa was primarily environmental, and much of the opposition to conventional agriculture and in favor of organic has been driven by environmental concerns.

Dr. Borlaug claimed the environmentalists had it precisely wrong. He explained, in a belief that has come to be known as the Borlaug Hypothesis, that the requirement to feed so many additional people will lead to massive environmental destruction as more land must be taken over for raising crops.

The only way to avoid this, he explained, is by increasing the yield on land that is already being used for agriculture.

So high intensity farming is the real friend of the environment, avoiding deforestation.

Second, is a sense that the environmentalists are a little afraid to speak about but clearly is a concern, which is that Dr. Borlaug and his ilk are not saving people's lives, they are enabling overpopulation.

But those who think this way are almost surely wrong. Economic development is everywhere associated with declining birthrates. When people practice subsistence agriculture, they need lots of children to labor in the fields. But as things advance, children become an expense as they need to be educated. Therefore, families decide to have fewer children.

So intensive agriculture does not so much enable overpopulation as enable development, which minimizes population growth.

Dr. Norman Borlaug is gone now. A truly great man for he truly did great things. He worked mostly in developing countries, but he brought with him an American attitude toward science as the hope for the future. It would be a horrible betrayal of all he stood for to forswear the blessings of science and retreat into a kind of fantasyland of low input agriculture and thinking that locally grown, organic product will feed the people of the entire world. 🌐



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