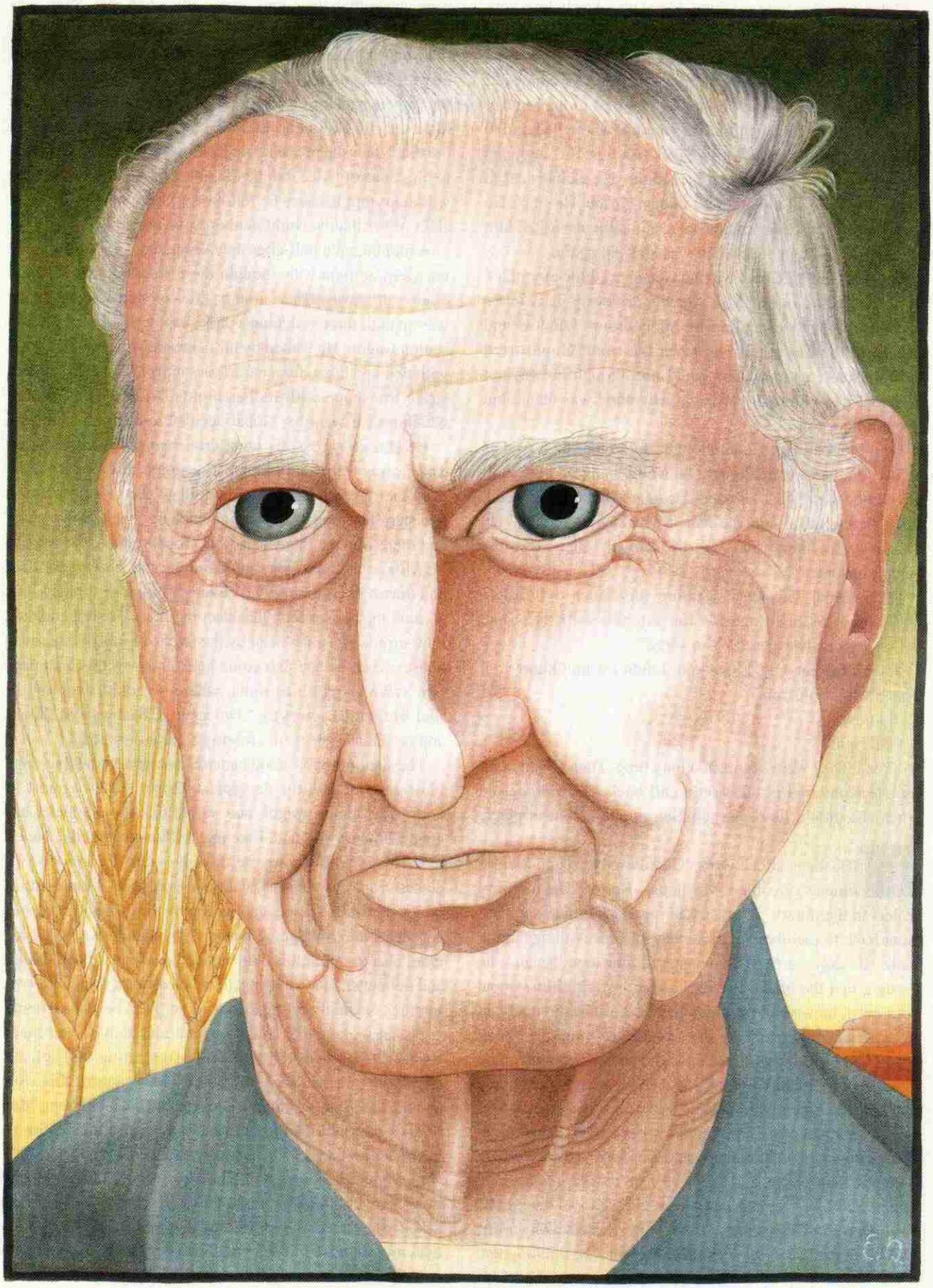


Illustrations by Etienne Delessert

Forgotten Benefactor of Humanity

by GREGG EASTERBROOK

Norman Borlaug, the agronomist whose discoveries sparked the Green Revolution, has saved literally millions of lives, yet he is hardly a household name

AMERICA has three living winners of the Nobel Peace Prize, two universally renowned and the other so little celebrated that not one person in a hundred would be likely to pick his face out of a police lineup, or even recognize his name. The universally known recipients are Elie Wiesel, who for leading an exemplary life has been justly rewarded with honor and acclaim, and Henry Kissinger, who in the aftermath of his Nobel has realized wealth and prestige. America's third peace-prize winner, in contrast, has been the subject of little public notice, and has passed up every opportunity to parley his award into riches or personal distinction. And the third winner's accomplishments, unlike Kissinger's, are morally unambiguous. Though barely known in the country of his birth, elsewhere in the world Norman Borlaug is widely considered to be among the leading Americans of our age.

Borlaug is an eighty-two-year-old plant breeder who for most of the past five decades has lived in developing nations, teaching the techniques of high-yield agriculture. He received the Nobel in 1970, primarily for his work in reversing the food shortages that haunted India and Pakistan in the 1960s. Perhaps more than anyone else, Borlaug is responsible for the fact that throughout the postwar era, except in sub-Saharan Africa, global food production has expanded faster than the human population, averting the mass starvations that were widely predicted—for example, in the 1967 best seller *Famine—1975!* The form of agriculture that Borlaug preaches may have prevented a billion deaths.

Yet although he has led one of the century's most accomplished lives, and done so in a meritorious cause, Borlaug has never received much public recognition in the United States, where it is often said that the young lack heroes to look up to. One reason is that Borlaug's deeds are done in nations remote from the media spotlight: the Western press covers tragedy and strife in poor countries, but has little to say about progress there. Another reason is that Borlaug's mission—to cause the environment to produce significantly more food—has come to be seen, at least by some securely

affluent commentators, as perhaps better left undone. More food sustains human population growth, which they see as antithetical to the natural world.

The Ford and Rockefeller Foundations and the World Bank, once sponsors of his work, have recently given Borlaug the cold shoulder. Funding institutions have also cut support for the International Maize and Wheat Center—located in Mexico and known by its Spanish acronym, CIMMYT—where Borlaug helped to develop the high-yield, low-pesticide dwarf wheat upon which a substantial portion of the world's population now depends for sustenance. And though Borlaug's achievements are arguably the greatest that Ford or Rockefeller has ever funded, both foundations have retreated from the last effort of Borlaug's long life: the attempt to bring high-yield agriculture to Africa.

The African continent is the main place where food production has not kept pace with population growth: its potential for a Malthusian catastrophe is great. Borlaug's initial efforts in a few African nations have yielded the same rapid increases in food production as did his initial efforts on the Indian subcontinent in the 1960s. Nevertheless, Western environmental groups have campaigned against introducing high-yield farming techniques to Africa, and have persuaded image-sensitive organizations such as the Ford Foundation and the World Bank to steer clear of Borlaug. So far the only prominent support for Borlaug's Africa project has come from former President Jimmy Carter, a humanist and himself a farmer, and from the late mediagenic multimillionaire Japanese industrialist Ryoichi Sasakawa.

Reflecting Western priorities, the debate about whether high-yield agriculture would be good for Africa is currently phrased mostly in environmental terms, not in terms of saving lives. By producing more food from less land, Borlaug argues, high-yield farming will preserve Africa's wild habitats, which are now being depleted by slash-and-burn subsistence agriculture. Opponents argue that inorganic fertilizers and controlled irrigation will bring a new environmental stress to the one continent where the chemical-based approach to food production has yet to catch on. In this debate the moral imperative of food for the world's malnourished—whether they "should" have been born or not, they must eat—stands in danger of being forgotten.

THE LESSON OF THE DUST BOWL

NORMAN Borlaug was born in Cresco, Iowa, in 1914. Ideas being tested in Iowa around the time of his boyhood would soon transform the American Midwest into "the world's breadbasket," not only annually increasing total production—so methodically that the increases were soon taken for granted—but annually improving yield, growing more bushels of grain from the same amount of land or less. From about 1950 until the 1980s midwestern farmers improved yields by around three percent a year, more than doubling the overall yield through the period. This feat of expansion was so spectacular that some pessimists declared it was a special case that could never be repeated. But it has been done again, since around 1970, in China.

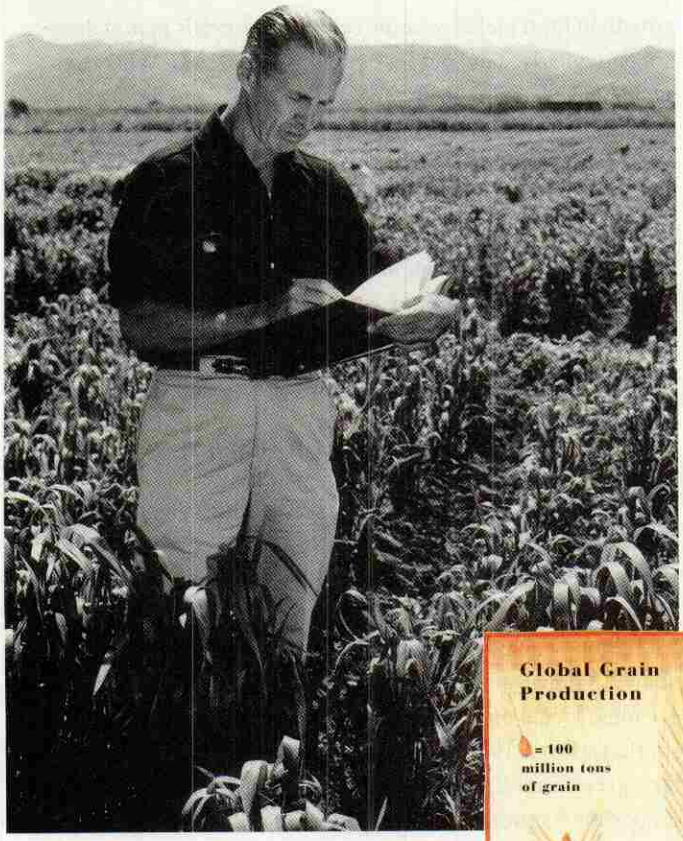
Entering college as the Depression began, Borlaug worked for a time in the Northeastern Forestry Service, often with men from the Civilian Conservation Corps, occasionally dropping out of school to earn money to finish his degree in forest management. He passed the civil-service exam and was accepted into the Forest Service, but the job fell through. He then began to pursue a graduate degree in plant pathology. During his studies he did a research project on the movement of spores of rust, a class of fungus that plagues many crops. The project, undertaken when the existence of the jet stream was not yet known, established that rust-spore clouds move internationally in sync with harvest cycles—a surprising finding at the time. The process opened Borlaug's eyes to the magnitude of the world beyond Iowa's borders.

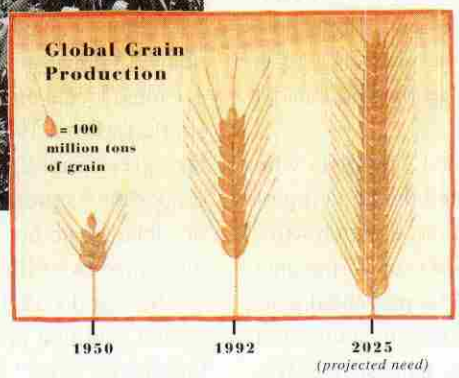
At the same time, the Midwest was becoming the Dust Bowl. Though some mythology now attributes the Dust Bowl to a conversion to technological farming methods, in Borlaug's mind the problem was the lack of such methods. Since then American farming has become far more technological, and no Dust Bowl conditions have recurred. In the summer of 1988 the Dakotas had a drought as bad as that in the Dust Bowl, but clouds of soil were rare because few crops failed. Borlaug was horrified by the Dust Bowl and simultaneously impressed that its effects seemed least where high-yield approaches to farming were being tried. He decided that his life's work would be to spread the benefits of high-yield farming to the many nations where crop failures as awful as those in the Dust Bowl were regular facts of life.

In 1943 the Rockefeller Foundation established the precursor to CIMMYT to assist the poor farmers of Mexico, doing so at the behest of the former Secretary of Agriculture Henry Wallace, of the Pioneer Hi-Bred seed company family, who had been unable to extract any money from Congress for agricultural aid to Mexico. Soon Borlaug was in Mexico as the director of the wheat program—a job for which there was little competition, backwater Mexico in the 1940s not being an eagerly sought-after posting. Except for brief intervals, he has lived in the developing world since.

The program's initial goal was to teach Mexican farmers new farming ideas, but Borlaug soon had the institution seeking agricultural innovations. One was "shuttle breeding," a technique for speeding up the movement of disease immunity between strains of crops. Borlaug also developed cereals that were insensitive to the number of hours of light in a day, and could therefore be grown in many climates.

Borlaug's leading research achievement was to hasten the perfection of dwarf spring wheat. Though it is conventional-





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July, 1961: Borlaug in Toluca, Mexico

ly assumed that farmers want a tall, impressive-looking harvest, in fact shrinking wheat and other crops has often proved beneficial. Bred for short stalks, plants expend less energy on growing inedible column sections and more on growing valuable grain. Stout, short-stalked wheat also neatly supports its kernels, whereas tall-stalked wheat may bend over at maturity, complicating reaping. Nature has favored genes for tall stalks, because in nature plants must compete for access to sunlight. In high-yield agriculture equally short-stalked plants will receive equal sunlight. As Borlaug labored to perfect his wheat, researchers were seeking dwarf strains of rice at the International Rice Research Institute, in the Philippines, another of the Ford and Rockefeller Foundations' creations, and at China's Hunan Rice Research Institute.

Once the Rockefeller's Mexican program was producing high-yield dwarf wheat for Mexico, Borlaug began to argue that India and other nations should switch to cereal crops. The proposition was controversial then and remains so today, some environmental commentators asserting that farmers in the developing world should grow indigenous crops (lentils in India, cassava in Africa) rather than the grains favored in the West. Borlaug's argument was simply that since no one had yet perfected high-yield strains of indigenous plants (high-yield cassava has only recently been available), CIMMYT wheat would produce the most food calories for the developing world. Borlaug particularly favored wheat because it grows in nearly all environments and requires relatively little pesticide, having an innate resistance to insects.

CIMMYT's selectively bred wheat, no longer a wholly natural plant, would not prosper without fertilizer and irrigation, however. High-yield crops sprout with great enthusiasm, but the better plants grow, the more moisture they demand and the faster they deplete soil nutrients. Like most agronomists, Borlaug has always advocated using organic fertilizers—usually manure—to restore soil nutrients. But the way to attain large quantities of manure is to have large herds of livestock, busily consuming the grain that would otherwise feed people. Inorganic fertilizers based on petroleum and other minerals can renew soil on a global scale—at least as long as the petroleum holds out.

THE GREEN REVOLUTION

TO Borlaug, the argument for high-yield cereal crops, inorganic fertilizers, and irrigation became irrefutable when the global population began to take off after the Second World War. But many governments of developing nations were suspicious, partly for reasons of tradition (wheat was then a foreign substance in India) and partly because contact between Western technical experts and peasant farmers might shake up feudal cultures to the discomfort of the elite classes. Meanwhile, some commentators were suggesting that it would be wrong to increase the food supply in the developing world: better to let nature do the dirty work of restraining the human population.

Yet statistics suggest that high-yield agriculture brakes population growth rather than accelerating it, by starting the progression from the high-birth-rate, high-death-rate societies of feudal cultures toward the low-birth-rate, low-death-rate societies of Western nations. As the former Indian diplomat Karan Singh is reported to have said, "Development is the best contraceptive." In subsistence agriculture children are viewed as manual labor, and thus large numbers are desired. In technical agriculture knowledge becomes more im-

portant, and parents thus have fewer children in order to devote resources to their education.

In 1963 the Rockefeller Foundation and the government of Mexico established CIMMYT, as an outgrowth of their original program, and sent Borlaug to Pakistan and India, which were then descending into famine. He failed in his initial efforts to persuade the parastatal seed and grain monopolies that those countries had established after independence to switch to high-yield crop strains.

Despite the institutional resistance Borlaug stayed in Pakistan and India, tirelessly repeating himself. By 1965 famine on the subcontinent was so bad that governments made a commitment to dwarf wheat. Borlaug arranged for a convoy of thirty-five trucks to carry high-yield seeds from CIMMYT to a Los Angeles dock for shipment. The convoy was held up by the Mexican police, blocked by U.S. border agents attempting to enforce a ban on seed importation, and then stopped by the National Guard when the Watts riot prevented access to the L.A. harbor. Finally the seed ship sailed. Borlaug says, "I went to bed thinking the problem was at last solved, and woke up to the news that war had broken out between India and Pakistan."

Nevertheless, Borlaug and many local scientists who were his former trainees in Mexico planted the first crop of dwarf wheat on the subcontinent, sometimes working within sight of artillery flashes. Sowed late, that crop germinated poorly, yet yields still rose 70 percent. This prevented general wartime starvation in the region, though famine did strike parts of India. There were also riots in the state of Kerala in 1966, when a population whose ancestors had for centuries eaten rice was presented with sacks of wheat flour originating in Borlaug's fields.

Owing to wartime emergency, Borlaug was given the go-ahead to circumvent the parastatals. "Within a few hours of that decision I had all the seed contracts signed and a much larger planting effort in place," he says. "If it hadn't been for the war, I might never have been given true freedom to test these ideas." The next harvest "was beautiful, a 98 percent improvement." 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.

Borlaug's majestic accomplishment came to be labeled the Green Revolution. Whether it was really a revolution is open to debate. As Robert Kates, a former director of the World Hunger Program, at Brown University, says, "If you plot growth in farm yields over the century, the 1960s period does not particularly stand out for overall global trends. What does stand out is the movement of yield increases from the West to the developing world, and Borlaug was one of the crucial innovators there." Touring the subcontinent in the late 1960s and encountering field after field of robust wheat, Forrest Frank Hill, a former vice-president of the Ford Foundation, told Borlaug, "Enjoy this now, because nothing like it will ever happen to you again. Eventually the naysayers and the bureaucrats will choke you to death, and you won't be able to get permission for more of these efforts."

THE HIGH-YIELD BOOM

FOR some time this augury seemed mistaken, as Borlaug's view of agriculture remained ascendant. In 1950 the world produced 692 million tons of grain for 2.2 billion people; by 1992 production was 1.9 billion tons for 5.6 billion people—2.8 times the grain for 2.2 times the population. Global grain yields rose from 0.45 tons per acre to 1.1 tons; yields of corn, rice, and other foodstuffs improved similarly. From 1965 to 1990 the globe's daily per capita intake grew from 2,063 calories to 2,495, with an increased proportion as protein. Malnutrition continued as a problem of global scale but decreased in percentage terms, even as more than two billion people were added to the population.

The world's 1950 grain output of 692 million tons came from 1.7 billion acres of cropland, the 1992 output of 1.9 billion tons from 1.73 billion acres—a 170 percent increase from one percent more land. "Without high-yield agriculture," Borlaug says, "either millions would have starved or increases in food output would have been realized through drastic expansion of acres under cultivation—losses of pristine land a hundred times greater than all losses to urban and suburban expansion."

The trend toward harvesting more from fewer acres, often spun in the media as a shocking crisis of "vanishing farms," is perhaps the most environmentally favorable development of the modern age. Paul Waggoner, of the Connecticut Agricultural Experiment Station, says, "From long before Malthus until about forty-five years ago each person took more land from nature than his parents did. For the past forty-five years people have been taking less land from nature than their parents."

In developing nations where population growth is surging, high-yield agriculture holds back the rampant deforestation of wild areas. Waggoner calculates that India's transition to high-yield farming spared the country from having to plough an additional 100 million acres of virgin land—an area about equivalent to California. In the past five years India has been able to slow and perhaps even halt its national deforestation, a hopeful sign. This would have been impossible were India still feeding itself with traditionally cultivated indigenous crops.

BACKLASH

NONETHELESS, by the 1980s finding fault with high-yield agriculture had become fashionable. Environmentalists began to tell the Ford and Rockefeller Foundations and Western governments that high-yield techniques would despoil the developing world. As Borlaug turned his attention to high-yield projects for Africa, where mass starvation still seemed a plausible threat, some green organizations became determined to stop him there. "The environmental community in the 1980s went crazy pressuring the donor countries and the big foundations not to support ideas like inorganic fertilizers for Africa," says David Seckler, the director of the International Irrigation Management Institute.

Environmental lobbyists persuaded the Ford Foundation and the World Bank to back off from most African agriculture projects. The Rockefeller Foundation largely backed away too—though it might have in any case, because it was shifting toward an emphasis on biotechnological agricultural research. "World Bank fear of green political pressure in Washington became the single biggest obstacle to feeding Africa," Borlaug says. The green parties of Western Europe persuaded most of their governments to stop supplying fertilizer to Africa; an exception was Norway, which has a large crown corporation that makes fertilizer and avidly promotes its use. Borlaug, once an honored presence at the Ford and Rockefeller Foundations, became, he says, "a tar baby to them politically, because all the ideas the greenies couldn't stand were sticking to me."

Borlaug's reaction to the campaign was anger. He says, "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."

In 1984, at the age of seventy-one, Borlaug was drawn out of retirement by Ryoichi Sasakawa, who with Jimmy Carter was working to get African agriculture moving. Carter was campaigning in favor of fertilizer aid to Africa, as he still does today. The former President had fallen in with Sasakawa, who during the Second World War had founded the National Essence Mass Party, a Japanese fascist group, but who in later life developed a conscience. Today the Sasakawa Peace Foundation is a leading supporter of disarmament initiatives; Carter and Sasakawa often made joint appearances for worthy causes.

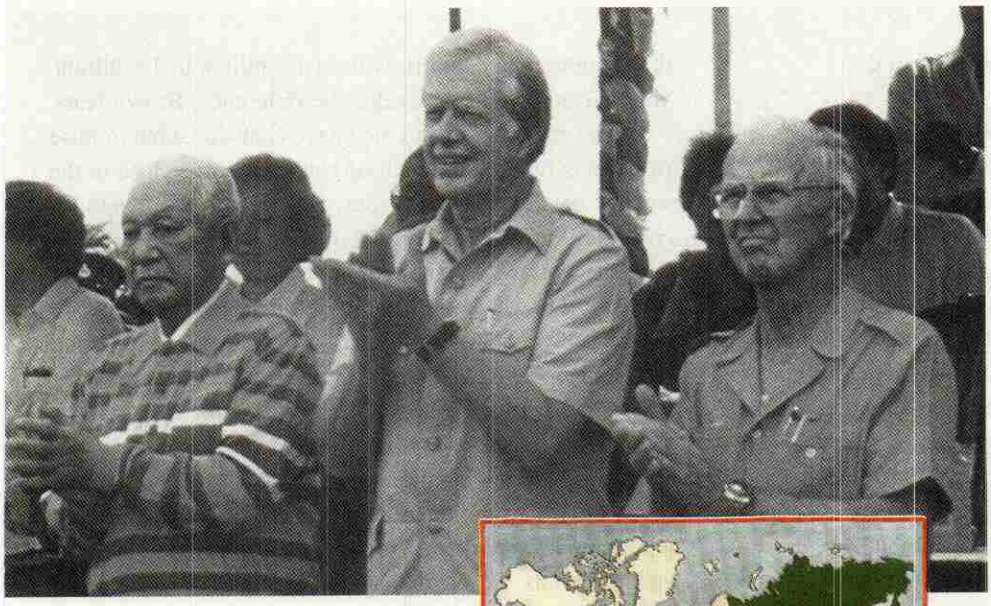
Sasakawa called Borlaug, who related his inability to obtain World Bank or foundation help for high-yield-agriculture initiatives in Africa. Sasakawa was dumbfounded that a Nobel Peace Prize winner couldn't get backing for a philanthropic endeavor. He offered to fund Borlaug in Africa for five years. Borlaug said, "I'm seventy-one. I'm too old to start again." Sasakawa replied, "I'm fifteen years older than you, so I guess we should have started yesterday." Borlaug, Carter, and Sasakawa traveled to Africa to pick sites, and the foundation Sasakawa–Global 2000 was born. "I assumed we'd do a few years of research first," Borlaug says, "but after I saw the terrible circumstances there, I said, 'Let's just start growing.'" Soon Borlaug was running projects in Benin, Ethiopia, Ghana, Nigeria, Sudan, Tanzania, and Togo. Yields of corn quickly tripled; yields of wheat, cassava, sorghum, and cow peas also grew.

Borlaug made progress even in Sudan, near the dry Sahel, though that project ended with the onset of Sudan's civil war, in 1992. Only Sasakawa's foundation came forward with more funds, but although well endowed, it is no World Bank. Environmentalists continued to say that chemical fertilizers would cause an ecological calamity in Africa.

Opponents of high-yield agriculture "took the numbers for water pollution caused by fertilizer runoff in the United States and applied them to Africa, which is totally fallacious," David Seckler says. "Chemical-fertilizer use in Africa is so tiny you could increase application for decades before causing the environmental side effects we see here. Meanwhile, Africa is ruining its wildlife habitat with slash-and-burn farming, which many commentators romanticize because it is indigenous." Borlaug found that some foundation managers and World Bank officials had become hopelessly confused regarding the distinction between pesticides and fertilizer. He says, "The opponents of high-yield for Africa were speaking of the two as if they were the same because they're both made from chemicals, when the scales of toxicity are vastly different. Fertilizer only replaces substances naturally present in the soils anyway."

In Africa and throughout the developing world Borlaug and most other agronomists now teach forms of "integrated pest management," which reduces pesticide use because chemicals are sprayed at the most vulnerable point in an insect's life cycle. Borlaug says, "All serious agronomists know that pesticides must be kept to a minimum, and besides, pesticides are expensive. But somehow the media believe the overspraying is still going on, and this creates a bias against high-yield agriculture." Indonesia has for nearly a decade improved rice yields while reducing pesticide use by employing integrated pest management. The use of pesticides has been in decline relative to farm production for more than a decade in the United States, where the use of fertilizer, too, has started declining relative to production.

Such developments have begun to sway some of Borlaug's opposition. The Committee on Sustainable Agriculture, a coalition of environmental and development-oriented groups, has become somewhat open to fertilizer use in Africa. "The environmental movement went through a phase of revulsion



Where Borlaug has worked

against any chemical use in agriculture," says Robert Blake, the committee's chairman. "People are coming to realize that is just not realistic. Norman has been right about this all along." One reason the ground is shifting back in his direction, Borlaug believes, is that the green parties of Europe have been frightened by the sudden wave of migrants entering their traditionally low-immigration nations, and now think that improving conditions in Africa isn't such a bad idea after all.

Supposing that opposition to high-yield agriculture for Africa declines, the question becomes What can be accomplished there? Pierre Crosson, an agricultural analyst for the nonpartisan think tank Resources for the Future, calculates that sub-Saharan Africa needs to increase farm yields by 3.3 percent annually for the next thirty years merely to keep pace with the population growth that is projected. This means that Africa must do what the American Midwest did.

"Africa has the lowest farm yields in the world and also a large amount of undeveloped land, so in theory a huge increase in food production could happen," says John Bongaarts, the research director of the Population Council, a nonprofit international research organization. "If southern Sudan was parked in the Midwest, they'd be growing stuff like crazy there now." Practical problems, however, make Bongaarts think that rapid African yield increases are "extremely unlikely in the near future." The obvious obstacles are desperate poverty and lack of social cohesion. When Borlaug transformed the agriculture of Pakistan and India, those nations had many problems but also reasonably well organized economies, good road and rail systems, irrigation projects under way, and an established entrepreneurial ethos. Much of Africa lacks these.

Additionally, African countries often lack a social focus on increasing agricultural output. Young men, especially, consider the farm a backwater from which they long to escape to the city. African governments and technical ministries tend to look down on food production as an old-fashioned economic sector, longing instead for high-tech facilities that suggest Western prestige and power. Yet a basic reason that the United States and the European Union nations are so strong is that they have achieved almost total mastery over agriculture, producing ample food at ever-lower prices.

Environmental groups have campaigned against introducing high-yield farming to Africa. The moral imperative of food for the malnourished—whether they "should" have been born or not, they must eat—stands in danger of being forgotten.

Ryoichi Sasakawa, Jimmy Carter, and Norman Borlaug, 1989

An encouraging example of an African government taking a progressive view of agriculture comes from Ethiopia, where, since the end of its civil war, Borlaug has run his most successful African project. Visiting Ethiopia in 1994, Jimmy Carter took Prime Minister Meles Zenawi on a tour of places where Borlaug's ideas could be tested, and won Zenawi's support for an extension-service campaign to aid farmers. During the 1995–1996 season Ethiopia recorded the greatest harvests of major crops in its history, with a 32 percent increase in production and a 15 percent increase in average yield over the previous season. Use of the fertilizer diammonium phosphate was the key reform. The rapid yield growth suggests that other sub-Saharan countries may also have hope for increased food production.

Whether Africa can increase its food production may soon become one of *the* questions of international affairs. It may be one at which, in a decade or two, Western governments will frantically throw money after a crisis hits, whereas more-moderate investments begun now might avert the day of reckoning. And one of *the* questions of the next century may be whether the world can feed itself at all.

10 BILLION MOUTHS

HIS opponents may not know it, but Borlaug has long warned of the dangers of population growth. "In my Nobel lecture," Borlaug says, "I suggested we had until the year 2000 to tame the population monster, and then food shortages would take us under. Now I believe we have a little longer. The Green Revolution can make Africa productive. The breakup of the former Soviet Union has caused its grain output to plummet, but if the new republics recover economically, they could produce vast amounts of food. More fertilizer can make the favored lands of Latin America—especially Argentina and Brazil—more productive. The *cerrado* region of Brazil, a very large area long assumed to be infertile because of toxic soluble aluminum in the soil, may become a breadbasket, because aluminum-resistant crop strains are being developed." This last is an example of agricultural advances and environmental protection going hand in hand: in the past decade the deforestation rate in the Amazon rain forest has declined somewhat, partly because the *cerrado* now looks more attractive.

Borlaug continues, "But Africa, the former Soviet republics, and the *cerrado* are the last frontiers. After they are in use, the world will have no additional sizable blocks of arable land left to put into production, unless you are willing to level whole forests, which you should not do. So future food-production increases will have to come from higher yields. And though I have no doubt yields will keep going up, whether they can go up enough to feed the population monster is another matter. Unless progress with agricultural yields remains very strong, the next century will experience sheer human misery that, on a numerical scale, will exceed the worst of everything that has come before."

But "very strong" progress on yields seems problematic. John Bongaarts calculates that agricultural yields outside Western countries must double in the coming century merely to maintain current—and inadequate—nutrition levels. The United Nations projects that human numbers will reach about 9.8 billion, from about 5.8 billion today, around the year 2050. To bring the entire world's diet in that year to a level comparable to that of the West, Bongaarts calculates, would require a 430 percent increase in food production.

Lester Brown, the head of the Worldwatch Institute, an environmental organization, fears that China may soon turn from an agricultural success story into a nation of shortages. Because much of it is mountainous, China already uses most of its attractive tillage area, leaving scant room for expansion. Its remarkable improvements in wheat and rice yields have come in part, Brown thinks, at the expense of depleting the national water table: irrigation water may soon become scarce. As newly affluent Chinese consumers demand more chicken and beef, feeding increased amounts of grain to animals may cause grain scarcity. If, as some experts project, the Chinese population rises from 1.2 billion to 1.6 billion, yield increases will not bridge the difference, Brown fears.

Privatization and dwarf rice have enabled China to raise rice yields rapidly to about 1.6 tons per acre—close to the world's best figure of two tons. But recently rice-yield increases have flattened. The International Rice Research Institute is working on a new strain that may boost yields dramatically, but whether it will prosper in the field is unknown. Ismail Serageldin, the chairman of the Consultative Group on International Agricultural Research, in Washington, D.C., believes that the "biological maximum" for rice yield is about seven tons per acre—four times today's average in developing countries, but perhaps a line that cannot be crossed.

An important unknown is whether genetic engineering will improve agricultural yields. Corn is among the highest-yielding plants. "If the high natural multiples of maize could be transferred by gene engineering to wheat or rice, there could be a tremendous world yield improvement," Paul Waggoner, of the Connecticut Agricultural Experiment Station, says. So far genetic engineering has not produced any higher-yielding strains, though it does show promise for reducing pesticide application. Some researchers also think that biotechnology will be able to pack more protein and minerals into cereal grains. Others, Borlaug among them, are skeptical about whether yield itself can be engineered. So far gene recombination can move only single genes or small contiguous gene units. Borlaug says, "Unless there is one master gene for yield, which I'm guessing there is not, engineering for yield will be very complex. It may happen eventually, but through the coming decades we must assume that gene engineering will not be the answer to the world's food problems."

Today Borlaug divides his time among CIMMYT, where he teaches young scientists seeking still-more-productive crop strains for the developing world; Texas A&M, where he teaches international agriculture every fall semester; and the Sasakawa–Global 2000 projects that continue to operate in twelve African nations.

Borlaug's Africa project is a private-sector effort run by an obscure Nobel Peace Prize winner and a former American President whose altruistic impulses are made sport of in the American press. Its goal is something the West seems almost to have given up on—the rescue of Africa from human suffering. Recently Western governments have been easing out of African aid, pleading "donor fatigue," the difficulty of overcoming corruption, and fear of criticism from the environmental lobby. Private organizations, including Borlaug's, Catholic Relief Services, and Oxfam, carry on what's left of the fight.

If overpopulation anarchy comes, it is likely to arrive first in Africa. Borlaug understands this, and is using his remaining years to work against that cataclysm. The odds against him seem long. But then, Norman Borlaug has already saved more lives than any other person who ever lived.