

# LIVING HISTORY INTERVIEW

With

**Dr. Norman E. Borlaug**

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## BIOGRAPHY

In 1970, the Nobel Peace Prize, a prize which usually is awarded to political figures, was awarded to a scientist, Dr. Norman E. Borlaug. Dr. Borlaug is known as the father of the "Green Revolution," a name which refers to the application of modern technology to agriculture in developing nations, to increase food production dramatically.

Dr. Borlaug was born in 1914 in Cresco, Iowa, and since 1944 has lived outside of the United States in nations with food production problems. Trained as a scientist at the University of Minnesota, he received his B.S. in forestry and an M.S. and Ph.D. in plant pathology. Approaching his fiftieth year working to increase world food production, Dr. Borlaug now divides his year between work for the Wheat Research and Production Program of the International Maize and Wheat Improvement Center (CIMMYT) in Mexico, a Maize and Sorghum Production Program in six sub-Saharan African countries sponsored by Sasakawa Global-2000, and a semester teaching in America. He is currently teaching at Texas A & M University.

Dr. Borlaug was an Associate Director of the Rockefeller Foundation for over twenty years, and has served as a consultant with the Food and Agriculture Organization (FAO) of the United Nations. He has been awarded honorary degrees from over thirty universities including Punjab Agricultural University in India, Universidad de la Plata in Argentina, Universidad Catolica de Chile, Universitat Hohenheim in Germany, Michigan State University, Columbia University, and Tokyo University of Agriculture in Japan. He is a member of U.S. National Academy of Sciences, and honorary member of ten foreign academies of science. Dr. Borlaug has received dozens of academic, scientific, and achievement awards, including the Jefferson Award from the American Institute for Public Service, a Diploma de Merito from the Instituto Tecnologico y de Estudios Superiores de Monterrey in Mexico, and the Recognition Award of the Agricultural Institute of Canada.



DR. NORMAN E. BORLAUG

The following interview was conducted by the editorial board of **TLCP** in October 1991.

**TLCP:** Dr. Borlaug, what made you dedicate your life to increasing world food production?

**BORLAUG:** My interest in world hunger and trying to do something about it dates back to the early 1930s, during the Great Depression. I saw local bank failures in Northern Iowa, where I grew up, and I saw many farmers lose their land. I saw their personal property sold by sheriff's sales. The whole country experienced economic disaster. In the Fall of 1933, when I enrolled at the University of Minnesota, I was introduced to the unpleasant conditions in a large city—huge numbers of unemployed sleeping on the streets hungry, begging for food. A few years later, in 1935, I was employed to supervise emergency work programs in forestry and soil conservation. The men working in these programs were in dire need of food and job opportunities. I saw young men, seventeen or eighteen years old, arrive at the Civilian Conservation Corps camps hungry and malnourished. At the camps they were able to recover some semblance of health and self-confidence. I saw how food changed them. Later I supervised a forestry program of the Works Progress Administration (WPA) with senior citizens who were destitute. All of this left scars on me.

A few months before Pearl Harbor, I had just received my coursework for a Ph.D. in plant pathology, and had started a job with a large chemical company to work on agricultural chemicals. As the war unfolded, the biological laboratory that I directed was put under the jurisdiction of the armed forces, and, being a microbiologist, I was classified as "essential to the war effort." After I was removed from the "essential to the war effort" category in 1944, I took up a position with the cooperative Mexican Government/Rockefeller Agricultural Program. This was the first international technical assistance program.

Upon arriving in Mexico, I was assigned to develop a wheat research and production program. I started from scratch since at that time there were virtually no trained people in scientific agriculture in Mexico. In addition, there was no extension service to move research results to the field, so we did it ourselves. That Mexican program and all of the subsequent Rockefeller Foundation programs were founded not only to develop appropriate agricultural production technology, but also to train young host country scientists, including preparing them to assume the leadership of their countries' programs. In addition, there had to be modifications in economic policy. Many other hurdles had to be overcome apart from developing the scientific package and testing it on farmers'

fields. One had to overcome the psychological barriers of acceptance of the technology by the small, often illiterate, farmers. One had to cope with economic planners. Of course, in the middle 1940s, we had no such creatures in Mexico, so we had to involve ourselves in the most fundamental of economic policy considerations in order to put the technology to use. Subsequently, in other countries, I had to cope with very sophisticated economic planners, often highly knowledgeable in theory but very unrealistic as to its application. Finally, I had to learn to deal with political leaders ranging from Presidents or Prime Ministers, Cabinet Ministers and Governors.

There also were many technical problems, including: how to restore fertility to worn out soils; how to cope with weeds; how to utilize the moisture most efficiently, be it rain-fed or applied through irrigation; how to control diseases and pests; how to harvest and store; and how to market. All of this had to become part of our program. I saw Mexico, which imported sixty percent of the wheat it consumed when we began, become self-sufficient by 1956, about eleven years after the program had started. We continued to improve the wheat plant's disease-resistance so that a greater percentage of the genetic potential that had been incorporated into this plant material could be expressed in terms of higher grain yield. In addition, from 1956 onward, we began to make dramatic progress in increasing grain yields. This was achieved through the introduction of dwarfing genes which reduced lodging (plants falling over) and by improving the plants' efficiency by reducing the straw to grain ratio. By 1960 we had trained enough Mexican scientists to assume the responsibility for all aspects of the Mexican wheat program. At that time I was about to leave to begin other activities, perhaps to become a specialist in banana production, of all things.

**TLCP:** What made you decide to stick with international efforts to increase cereal production?

**BORLAUG:** When I was considering shifting to employment in the private sector, I was sent on a mission by the Rockefeller Foundation and the FAO to look at worldwide wheat production problems in developing nations. After several months of travel and study, I reported that the greatest problem, except in India and Egypt, was the shortage of trained young scientists in the various disciplines that bear on crop production. In India and Egypt, a considerable number of capable, very well-trained wheat scientists existed, but their programs were organized to operate, all too often, as a continuation of their doctoral theses at European, American, or Canadian universities, rather than to bear directly on increasing food production.

The result was that when I made my report to FAO, I suggested that we bring young students from African and Asian countries to Mexico, where I would train them in both wheat research and production skills. This program came into being in 1961, with Rockefeller Foundation funding, and is the main reason I stuck with international efforts. These students gradually became linked into an international network of young wheat scientists. We knit that linkage together more tightly by establishing the International Wheat Yield Test, in which the wheats we had developed in Mexico were directly compared in many countries under farmers' field conditions to the best commercial varieties of the host country as well as to the best commercial varieties of the United States, Canada, and Australia. They proved to be better adapted and to be superior to other strains of wheat in many conditions around the globe.

A few years later, when there was famine in India and Pakistan, and subsequently in China, I began to work with these and other countries using Mexican material to save time. In 1964 and 1965 India received five million tons of emergency wheat grain aid per year from the United States under the USAID Food for Peace Program. In spite of this, the famine worsened.

During this time, after two years of testing the Mexican wheat in small plots on farms in Pakistan and India, results justified importing 350 and 300 tons of Mexican Semidwarf Wheats into Pakistan and India respectively, for evaluation in one acre plots on thousands of farms in each country. There were great difficulties in shipping the seed, difficulties in planting, and difficulties with germination because of the war that was raging between the two countries. In spite of all the troubles, the results at harvest in 1966 were highly favorable in both countries.

**TLCP:** Was this the "Green Revolution?"

**BORLAUG:** Yes, these favorable results encouraged the Minister of Food and Agriculture, Shri C. Subramaniam, to import 18,000 tons of Mexican Wheat Seed for India in the fall of 1966. The following year Pakistan imported 42,000 tons, setting the stage for the so-called "Green Revolution."

Never in the history of world agriculture had more than 100 tons of seed of any grain crop been imported from one country to another, much less tens of thousands of tons. Critics said we were recklessly playing with the lives of millions, but instead, we produced a "Green Revolution."

As the result of the introduction of the wheat varieties we had developed in Mexico, together with improved production technology in Pakistan, Pakistan's wheat production has increased from 3.5 million tons in 1965 to more than fourteen million tons at present. India has experi-

enced an increase from eleven million to fifty-five million tons. China has had a large increase of the same magnitude. The increased production in Pakistan resulted in that country becoming self-sufficient in 1968. India became self-sufficient in wheat production in 1972 and in rice and all cereal grains in 1975, and has remained so ever since.

Permit me to use the revolution in Indian wheat production to illustrate the social impact of increased wheat yields. In 1991, an additional 44 million tons of wheat were harvested beyond the 1965 pre-wheat revolution levels. Using the FAO minimum recommended daily diet intake of 2350 kilocalories per capita as a standard, the additional 44 million tons of wheat grain harvested in 1991 is providing 65 percent of the calories for an additional 312 million Indians. When one reflects on the large number of people who have benefitted either directly or indirectly from the wheat revolution in many countries, the numbers are staggering.<sup>1</sup>

I am pleased to have been able to play a part, along with hundreds of scientific colleagues around the world, in triggering a wheat revolution that began in Mexico and evolved into the Green Revolution. This, I am sure, is my greatest satisfaction.

Meanwhile, the "population monster" tugs on the back of our coat and pulls us down everywhere in the developing world. When I first went to Mexico in 1944 there were 22 million people. Today there are 91 million. When I first began to work in India there were 450 million people, today there are 850 million. So the question becomes, "How much longer can the world continue to produce the basic needs in food for an exploding population?" Today the world population is 5.4 billion and is increasing at the rate of ninety-seven million more every year. This is equivalent to adding one billion more people to the population every decade.

**TLCP:** How much of your life has been spent outside the Western, food-rich countries?

**BORLAUG:** Since that day in 1944 when I went to Mexico, I have worked in food-deficit nations. The first forty years of that time were spent uninterruptedly in developing nations. I was based in Mexico but worked in many Latin American countries in the 1940s, 1950s, and 1960s, and in Asia during the 1960s and 1970s (at the height of the famine in India, Pakistan, and China). During the last seven years, I have been engaged in

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1. Countries included are: Mexico, Pakistan, Guatemala, Chile, Argentina, Uruguay, Brazil, Bolivia, Paraguay, Ecuador, Colombia, Peru, China, Bangladesh, Iran, Iraq, Syria, Egypt, Saudi Arabia, Turkey, Afghanistan, Morocco, Tunisia, Algeria, Sudan, South Africa, Spain, Portugal, Italy, Greece, the Soviet Union, Australia, Canada and the United States.

agricultural programs in six sub-Saharan African countries. The struggle to produce enough food to alleviate suffering from hunger and malnutrition is deeply ingrained in me. It has only been in the last seven years that I have been able to return to the United States and teach one semester each year, first at the University of Minnesota and Cornell University and now at Texas A & M.

**TLCP:** How have you divided your time between fieldwork, laboratory-work, and library research? Why have you chosen not to spend much time writing academic papers?

**BORLAUG:** Since most of my work has been in food-deficit nations, eighty-five percent of my work has been in the field. You don't produce more food by writing learned papers. I am a researcher, but I have also been an activist. I am not satisfied with the idea that is widespread in the food abundant nations, namely, that good research will automatically be reflected in increased food production. Perhaps it would in time, but when dealing with hunger, one cannot wait. The different pieces of the jigsaw puzzle of production—the biology, the soil, the economic policy, and the politics—must be knit together to create a breakthrough as soon as possible. I have nothing against writing learned papers, but I think that developing nations would be better off if there were fewer learned papers written and more effort put into converting the pertinent knowledge into production. Unfortunately, many developing nations, such as India, produce an enormous number of scientific publications which are largely, I believe, for the self-advancement of the senior author, rather than for producing more food. Very often their scientists learned this order of priorities while studying as graduate students in European, U.S., and Canadian institutions. I would like to point out, however, that I too have sometimes been involved in rather sophisticated research, including laboratory work. However, my efforts in such cases have been directed at trying to solve some problem that could not be solved in the field.

**TLCP:** How is the international system trying to increase food production?

**BORLAUG:** Many developed nations currently assist through bilateral programs to help food-deficit nations improve their basic food production. In addition, there are now thirteen International Agricultural Research Centers funded by forty-two different nations. Sometimes there are so many different programs operating in a given country that the efficiency is considerably reduced. Several years ago in Kenya, there were hundreds of different projects operating. A much smaller number that focused on the urgent problems would have been more efficient.

**TLCP:** What are some other problems in international efforts to transfer technology and increase food production in developing countries?

**BORLAUG:** There needs to be a prompt and continuing application of agricultural knowledge and transfer of improved production technology to the developing world. Unfortunately, a direct technology transfer from affluent nations, such as the United States, generally will be unsuccessful because of mismatched levels of current agricultural production methods. Many of the foreign assistance programs have made this mistake and have wasted time and vast sums of money.

Moreover, most of the International Agricultural Research Centers, which are in their second decade, are not as effective now as they were five to eight years ago. They no longer are oriented toward the development of technology that is most urgently needed. About seven years ago, some of the International Agricultural Research Centers responded to pressures from the "parent organization," the Consultative Group on International Agricultural Research (CGIAR), and decided they should focus on fundamental research—so called upstream research—and turn over more of the applied research to the national programs. Disastrously, the indebtedness of developing nations and the resulting inflationary pressures have made this a non-realistic approach. Many of the national programs in developing countries are actually weaker now than they were a decade ago. Many of their best scientists have left public-sector employment because it has become impossible because of inflation for them to make a decent living in these institutions. Meanwhile, the International Agricultural Research Centers continue to pursue more upstream research (such as molecular genetics, rather than the more pragmatic research that they did in the first decade), while the national research programs become less and less effective.

Turnover of personnel, whether in bilateral or in international programs, decreases efficiency—lack of continuity slows down and confuses the programs. Most of the people assigned from the developed nations to bilateral technical assistance programs remain in a given foreign post for three to four years at most. They are then moved to a similar program in a different country, in a different linguistic area, with a different climate, and often to work on a different group of crops. Their impact and efficiency consequently decreases. In addition to the lack of continuity, the lack of scientists with interdisciplinary experience or a farm background further handicaps many of the foreign technical assistance programs that are sponsored and led by scientists from affluent nations. Fortunately, in recent years this seems to be changing. A substantial number of young scientists now enrolled in U.S. graduate schools are people who have served in the Peace Corps. Although many of them did not have an agricultural or technical background when they served in the Corps, they

gained valuable experience while working on agricultural and rural development programs, including teaching, before returning to graduate school. It appears that a considerable number of Ex-Peace Corps workers—now graduate students—hope to pursue careers in agriculture in developing nations, provided they can find employment in either bilateral or international organizations, after they receive their degrees. They are potentially a very valuable resource and may contribute greatly to international agricultural improvement. They know what it is like to live in the bush, they are dedicated, and they have the breadth of experience that makes them highly effective.

**TLCP:** In the last fifty years, how has the involvement of national governments changed? Of international organizations? Of private companies? Of private charities? How do the norms surrounding hunger need to change further?

**BORLAUG:** The program that I joined in 1944, the Co-operative Mexican Government-Rockefeller Foundation program in agricultural improvement, was the first foreign agricultural technical assistance program. It predated the Marshall Plan by five years. It also preceded President Truman's Point Four address to the nation by six years. President Truman's Point Four program subsequently evolved into the U.S. Agency for International Development (USAID). The establishment of USAID focused the attention of governments of affluent nations on the plight of the Third World. Since then, many bilateral programs from developed countries have been designed to assist developing countries with their food production problems. They have had varying degrees of success, but their overall impact has been positive.

In the 1960s, four International Agricultural Research Centers were developed by the Rockefeller Foundation and the Ford Foundation. The first of these, The International Rice Research Institute (I.R.R.I.), which came into being in 1963, was patterned after the Mexican Government-Rockefeller Foundation wheat and maize programs. The second was the International Maize and Wheat Improvement Center (CIMMYT), with which I have been affiliated since its establishment in 1966. In 1971 the Consultative Group on International Agricultural Research (CGIAR), which represents governments, international organizations, and private foundations, collectively assumed the responsibility for financing the four International Agricultural Research Centers. The Centers, founded by the Ford and Rockefeller Foundations, were expanded into an international network of thirteen centers devoted to research designed to improve crop and animal production in different developing countries around the world. Recently two additional centers have been added.

The last time I checked—about three years ago—money going into the thirteen international research centers came from forty-two governments, plus the World Bank, Regional Development Banks, and several other donor agencies. The total annual budget was about 200 million dollars, which is a vast sum of money. But, if one stops to think about this sum in terms of the quantity of wheat, rice or maize that it would buy, it is modest. What economic benefits have come from the investments in the international research centers? I will mention only one example; the increase in wheat production in India that resulted from the transfer of high yield technology from Mexico in 1965. It increased production from eleven million tons to fifty-five million tons over the last twenty-six years. With wheat selling at 150 dollars per ton it only takes 1.333 million tons to pay for the entire budget of all thirteen centers. Such dramatic increases in production demonstrate the huge benefits from investments in research.

I must say, however, that research organizations are like people. You find an outstanding scientist, who goes through a sprouting or germination period, grows with experience, through diligent work becomes very productive, and sooner or later, reaches the pinnacle. Then the scientist become less productive. Research organizations are no different than individuals, and although they should be able to survive in a vigorous form for many human generations, they do not! The truth is that most research organizations germinate, grow vigorously in their youth, flower, and then begin to fade. Within a few decades, because of bureaucracy, lack of motivation, and perhaps lack of reorientation resulting from ineffective leadership, they become less and less effective. Paraphrasing the late F. F. Hill, former Vice President of the Ford Foundation, "It's unfortunate you can't kill organizations when they stop functioning well, but continue to survive siphoning off public funds!" Were it possible to channel the funds of the dying organization to begin a new organization, it should be possible to perhaps maintain productivity for another thirty or forty years, before it too inevitably would go through the same decaying process. Rather sad, isn't it?

**TLCP:** Is there a right to food?

**BORLAUG:** It is my firm belief that all who are born into this world have the basic right not only to food, but to the other essentials for a decent, humane life. This means access to food, clothing, adequate housing, education for the young, basic medical care, and above all, opportunity for gainful employment. A decent, humane life is not possible without these essential elements. I think that the United States, being a very wealthy nation, can provide these elements for all its citizens. It has attempted to do so with food stamps and other programs for the underprivileged, but,

despite these efforts, one does not even need to go into the slums to see many people that are obviously undernourished or malnourished and lacking in other essentials. We Americans have not done what needs to be done to remove poverty, including hunger, from our society. If the United States has these problems, imagine how much more difficult it is for developing nations that lack economic resources and the scientists and leaders to cope with the massive numbers of malnourished, undernourished, and unemployed people.

**TLCP:** What are the procedures for dealing with the world food situation—procedures for food production and food distribution?

**BORLAUG:** Whenever we talk about food we have to approach it from two standpoints. One is to produce adequate quantities of the right kind of food to feed this large and rapidly growing population. The second is to concern ourselves with the equity of distribution. Therein lies one of the great tragedies. Currently there are huge surpluses in the United States, certain Western European countries, Canada, Australia, New Zealand, and perhaps Argentina, which depress prices to the detriment of agricultural producing nations. At the same time, in many of the food-deficit nations there is a shortage of food because of poverty and a lack of purchasing power. The problem occurs at two levels: first, at the governmental level, there is not enough foreign hard currency exchange to import more than the minimum amount of food needed to escape devastating famine, especially in urban areas; second, even if adequate food could be imported, it would be impossible to distribute it equitably because the vast proportion of the population in food-deficit nations is poor and rural. Often seventy-five to eighty-five percent of the population are rural subsistence farmers. How do you get the imports into the stomachs of people who have no purchasing power? Poverty is the barrier, including lack of employment and job opportunities, and this seems to be growing worse rather than improving in many parts of the world. Moreover, an unsurmountable obstacle in getting food to the rural areas during emergencies is lack of transport.

If the minimum recommended 2350 kilocalories per day of food requirements were used, which is the standard which the FAO and the World Health Organization recommend, the basic foods that are produced today would be more than enough to feed the present world population of 5.4 billion were it not for poor distribution. However, many people in the affluent nations, such as the United States, are consuming more than 3000 calories per day causing obesity, which is sometimes deleterious to health.

This clearly illustrates that to solve the food problems of the world, much of the increased production of food must take place within the food

deficient nations themselves, where the vast majority of people are small subsistence farmers with no purchasing power except that from the sale of their agricultural produce.

**TLCP:** How important are private actions in dealing with the food problem?

**BORLAUG:** I wish that it were possible to have more private sector funds and companies involved in rural development and agriculture in all of its aspects in developing nations. But this won't happen very quickly. Within the last few months, we have seen a tremendous change in the political systems of the world. The collapse of socialist/communist systems in several parts of the world has brought both new hope, as well as fear and confusion into the minds of many people in both developed and developing nations. Many of the African, Latin American, and Asian nations had communist or socialist systems of government, for which the Soviet Union was their model for development. It will be very difficult to quickly transfer lands that have been in state farms or other types of public sector ownership to private sector farms. I don't know what the future will bring. But it is my belief that democracy cannot long survive when empty stomachs and human misery abound. To make matters worse the food situation is deteriorating in many countries because of horrendous inflation. If there is no improvement within two years, there may be a reversion to various types of socialist systems. With these uncertainties, private sector investment will be slow and inadequate so long as there is a fear that disillusionment may produce a reversion to socialistic/communist forms of government.

**TLCP:** Some people have expressed concern that "Green Revolution" technologies can only be used by the richer farmers in poor countries, making these farmers richer without helping the hungry. How do you respond?

**BORLAUG:** I think this is a gross over-exaggeration from people who live in academia in affluent nations of the world and have never lived in developing nations. They pontificate about many of these things on a purely theoretical basis. In India, the Green Revolution has resulted in 300 to 400 percent increase in yields on virtually all small, four to six acre wheat farms. There are very few thirty to forty acre farms in India. In the end, all wheat farmers benefitted. But the consumers became the greatest beneficiaries from this new technology, for it resulted in more and cheaper food for them.

Inequalities in food availability are older than agriculture itself (which dates back 12,000 to 14,000 years). During the hunting and gathering era, the strongest tribes held the best grazing land that provided

the easiest hunting of the largest ungulates, whereas the weaker tribes were pushed into the less privileged ecosystems with fewer and smaller animals to meet their food demands. Is it right, then, to expect improved science and technology—the Green Revolution—to correct all the social, economic and political inequalities dating back from the beginning of humankind up until the beginning of the Green Revolution in the 1960's? Let the critics answer.

**TLCP:** Some critics have accused the Green Revolution of raising false hopes that technology would indefinitely be able to increase crop yields. How imperative is population control in solving world hunger?

**BORLAUG:** Earlier in the interview I referred to the problem of the "population monster." I have always maintained that we who work in food production have a responsibility to warn the political, religious, and educational leaders and the general public that producing more food and fiber can be only a holding operation while the population monster is being tamed. More than two decades ago, when I accepted the Nobel Peace Prize in 1970, I said, "The Green Revolution had won only a temporary success and the frightening power of human reproduction must be curbed; otherwise, the success of the Green Revolution will be ephemeral." The Green Revolution was never offered as a permanent solution.

In recent years the issue of human rights has generated much interest and debate around the world. In the developing nations in which I have lived and worked, the attainment of human rights cannot be achieved as long as hundreds of millions of poverty-stricken people lack the basic necessities for a decent, humane life. I take issue with those who ignore the growing threats of the population monster. One cannot speak glibly and sanctimoniously about the right to life while ignoring the quality of life. Why does mankind continue to inadvertently and irresponsibly heap so many additional people onto the planet Earth? Why do we continue to believe that in the future, newer and better technologies will expand the carrying capacity of our planet while at the same time assuring an improving standard of living for all?

**TLCP:** The Green Revolution has also been criticized by members of the environmental movement. Do you have a reply to these criticisms?

**BORLAUG:** Some members of the environmental movement have played on public fears of harmful chemicals in our water, in our food, and in the air. The claim is that harmful chemicals are being incorporated into food because of pesticides, insecticides, fungicides, and herbicides, and that they are deleterious to our health. But where is the evidence? Are the chemicals reducing our longevity? Life expectancy continues to increase! Much of the reason for all of this confusion stems from two factors. One, there have

been vast improvements in chemical analysis over the last few decades. The tests are now highly sensitive and reveal very small amounts of a chemical (a fraction of a part per trillion). Two, testing procedures in experimental animals, based on high doses, tend to magnify the risk of exposure. These two factors have led to exaggerated fears of danger when no actual danger exists. Moreover, we now know that many "natural" foods which have been a part of the human diet since before the beginning of agriculture contain naturally occurring compounds that are toxic, mutagenic, carcinogenic, or otherwise harmful at high doses. One of the best examples is the cultivated mushroom, which contains low levels of several hydrazines, some of the most carcinogenic naturally occurring compounds. These hazardous substances are present at very dilute levels and probably play little or no role in causing cancer. Assuring a safe food supply is a very complex issue, but I am convinced that no nation in the history of the world has had a better source of safe, high-quality, and cheaper foods than the United States. And all this, despite the hysteria.

The greatest cause of pressure on the environment is the population explosion, not the use of agricultural technology. For example, the population explosion has led to the problem of deforestation. Many are concerned about the tropical rain forests that are being depleted at a frightening rate in South America (especially in Brazil), in the South of Mexico, in Africa, and in South Asia. There are several fears. One is that since the forest is the habitat for many species of plants and animals, deforestation will result in the mass extinction of these species. Others are concerned about the effect deforestation will have on the atmosphere and climate, especially when combined with the ever increasing release of carbon dioxide from fuel consumption, which normally would be tied up and removed from the air by the growing forest. In my opinion, concerns about deforestation do not show that agricultural policy needs to change. It shows that we need to control population. The numbers of human beings is the factor that is imposing the greatest risk to our environment. Isn't it curious that activists in the environmental movement and the spokesmen in defense of endangered species almost never speak out against the population monster?

The point is not that there should be no safeguards protecting the environment and human health from the possible damaging effects of modern agricultural and industrial technology. On the contrary, governments should make every effort to protect the health and welfare of their citizens. But the anti-technology bias so prevalent in affluent countries is both hypocritical and potentially damaging to the developing nations. In effect, the haves are telling the have-nots that they should stay with their

impoverished, rural life-styles, since greater material well-being leads to environmental destruction. Yet the people in the developed world are healthier and have the prospect of leading longer, more comfortable lives than those in developing nations. They are unwilling to trade places with poorer people in less developed nations because to do so would be to cut their life spans by one-third or more and to see up to half of their children die before reaching the age of ten.

**TLCP:** You mentioned that you have only recently started to spend part of your year in America. What is it like to come back to the United States after living abroad for so long?

**BORLAUG:** Seven years ago when I decided to return to the United States each year for one semester of teaching, I became frightened by many of the things I saw. It reminded me of apprehensions expressed by Thomas Jefferson: "Ease and security, were these the drugs that abated the eternal challenges in the minds of men? And did nations, like men, grow sluggish and apathetic when they were well fed and bodily comfortable?" When I came home, I became apprehensive. After World War II, the United States had developed into the world's greatest political, industrial, agricultural, and economic power. Our democratic traditions, hard work, educational system, and inventiveness were the envy of the world. Now, when I return home, I see a United States afflicted with the debilitating co-viruses of affluence and complacency. The fiscal irresponsibility of our federal government has led to horrendous indebtedness resulting in massive and growing debt-servicing charges. Many of our industries can no longer compete either in cost of production or in product quality with those in Germany, Japan, or the Pacific Rim. Meanwhile, many financiers and corporate leaders are engaged in preying on one another in hostile takeovers for short-term gains rather than dedicating their energies to long-term growth and improving the vitality of the American economy. I feel that our past national goals of excellence and achievement are being replaced by the pursuit of pleasure and comfort. We seem to want more pay for less work, yet don't know how to use the additional free time constructively. I pray that we will wake up in time to realize the folly before it is too late and the United States becomes a second-class nation.

I invariably try to challenge young students to utilize their years in universities to the fullest to develop the potential talents that they have inherited from their parents, grandparents, and great-grandparents. I challenge them not to be satisfied with mediocrity. Many will be surprised, if they develop their genetic potential to the maximum, by what they will be able to accomplish for themselves, their families, their states, their nations, and for humankind in the broadest context. I remind them that

education is a life-long process that doesn't terminate when one receives a degree.

I also remind students that it is disgraceful for a nation with the natural resource base that the United States is blessed with to lose ground in industrial development and competitiveness. I am fearful that most of the present generation, which lives in an affluence that has never been experienced by any generation anywhere in the world, takes this all for granted. As a result, we are falling behind not only in the industrial field, but also in academic scholarship and scientific and technological research. It behooves us to examine what is wrong at home.