

## Warrior In The Fight Against Hunger

By John R. Harvey

An interview with Nobel Peace Prize winner Norman E. Borlaug, leader of the "Green Revolution" that has dramatically increased grain yields around the world.

When historians of a future age sift through 20th century archives in search of the great scientist-humanitarians of our time, the name Norman Borlaug will be high on the list. His work as a plant geneticist culminated in the development of sturdy, short-stemmed wheat varieties that have helped check the specter of starvation in many of the lesser developed countries. He was awarded the Nobel Peace Prize in 1970 for his leadership role in the "Green Revolution."

Son of Norwegian immigrants, Borlaug was raised on a modest farm near Cresco, Iowa -- "little Norway," as the community is called. At the urging of his grandfather, he worked his way through the University of Minnesota during the depths of the Depression, receiving a B.S. degree in forestry in 1937. He worked as a forester before returning to the University, where he earned his Ph.D. degree in plant pathology in 1941.

Borlaug spent three years with Du Pont at its Experimental Station in Wilmington, Del., before joining a small team of agricultural scientists whose goal was to "export the U.S. agricultural revolution to Mexico." The project was sponsored by the Rockefeller Foundation.

When Borlaug arrived in Mexico in 1944, land was still being prepared for planting with a wooden plow pulled by mules or oxen; harvesting was done by hand and threshing was accomplished when oxen trod the grain, which was then thrown into the air for the wind to blow away the chaff -- as in Biblical times.

Borlaug immediately began his long search to improve Mexican wheat varieties which, over centuries of competing with weeds for sunlight, had evolved into tall plants with thin stems. When fed fertilizer and water to increase yield, the plants fell over or "lodged", as agronomists say. New varieties with shorter, stronger stems were needed.

Working with Dr. Orville A. Vogel, a Washington State University researcher who had developed a dwarf wheat called Gaines, the tenacious Borlaug crossed Gaines with the Mexican varieties. A young man in a hurry, the Iowa-born scientist grew two crops each year -- one just below the U.S. border, and another 800 miles south, near Mexico City. He exposed his progressive new crosses to repeated alternations of differing climate and growing period, thus breeding into them a revolutionary new adaptability to a wide range of conditions. The wheats have been successful all the way from the Equator to Turkey, near the 40th parallel, increasing wheat yields as much as 500 percent in some countries.

Still, Borlaug takes a cautious view of the ultimate benefit of his work, fearing that the "human population monster" transcends all other problems.

At 68, Borlaug is an active, globe-trotting director of the Wheat Research and Production Program for the International Maize and Wheat Improvement Center (CIMMYT), near Mexico City, and is an associate director of the Rockefeller Foundation. Always on the move, Borlaug was interviewed by Du Pont Context at New York's JFK Airport just before he boarded a jet for a month-long consulting trip to India and Pakistan.

Du Pont Context: On a global basis, is the food-population battle being won or lost?

Borlaug: The last several years, we've held our own -- but it's a precarious balance. Also, it depends on where you have poor harvests. For example, Russia has had two bad crop years in a row, but has the foreign exchange to buy large quantities of food on the international market. If the same thing should happen in one of the developing countries, we would have a severe crisis.

So, even though globally we are near balance, there's no room for complacency ... it's a constant struggle, since world population is growing at the rate of 76 million more people per year. If the world failed to meet the growth in demand for two or, at the most, three crop years, many countries would be plunged into social and political chaos.

Du Pont Context: Is that why you say the "food energy problem" is more critical than that of fossil fuels?

Borlaug: Yes. Food is the first basic necessity for all of us, and there are no acceptable substitutes for food energy. When stomachs go empty, patience wears out and anger flares.

For example, famine in the African Sahel countries, a few years ago, led to the fall of the governments in power, which were replaced by revolutionary governments of one kind or another. If the world is ever to achieve social, economic and political stability, I assure you it won't be done on empty stomachs.

Du Pont Context: India suffered its worst drought in 90 years in 1979 when the monsoon failed. Why didn't we hear more about this?

Borlaug: Despite the drought and the resulting poor rice harvest, India fed its people from the reserve grain stock and emerged still having a reserve of about 7 million tons of grain in storage when the wheat harvest of 1980 commenced.

As a result of the dramatic change in wheat and rice production, which made possible the accumulation of a large grain reserve buffer stock, a disastrous famine, which could have taken the lives of millions, was averted.

In 1975, when world population reached 4 billion, the world produced an all-time record harvest of about 3.3 billion metric tons of all kinds of food. It took from the beginning of agriculture and animal husbandry, some 12,000 years ago, to reach that record level.

Du Pont Context: But the Green Revolution happened over a relatively short period of time. How did it come about?

Borlaug: It took 12 years, from 1944 to 1956, to develop the new technology to make Mexico self-sufficient in wheat production. During the 1960's, it became apparent that much of the wheat production technology -- including the high-yielding, semi-dwarf varieties that were developed in Mexico -- could be used successfully in many other parts of the world when proper adjustments were made in agronomic practices to fit local soil and climatic conditions.

We've had the satisfaction of seeing wheat production in both India and Pakistan triple and that of Turkey double since 1967. Other countries that have made notable progress, based in large part on Mexican CIMMYT materials and methods, include Bangladesh, China, Egypt, Tunisia, Algeria, Morocco, Portugal, Iran, Iraq, Syria, Kenya, Zimbabwe, South Africa, Guatemala, Argentina, Brazil, Chile, Ecuador and the southwestern United States -- California, Arizona and New Mexico.

Du Pont Context: Is the Green Revolution over? If not, what's the next phase?

Borlaug: After wheat, the Revolution caught on with rice. I believe maize -- corn -- is the breakthrough coming soon in many of the Third World countries. We now have broadly adapted varieties of corn that fit just like our wheat and rice did. Through breeding, we have developed high lysine corn that is hardy, higher yielding and more disease resistant. But one

or two crops can't carry it. I have faith we can continue to push these programs with the other basic crops the world lives on.

Du Pont Context: Most scholars agree that the population of the world will reach 8 billion in the next 50 to 60 years. Can worldwide food and fiber production be doubled in that length of time?

Borlaug: I am cautiously optimistic and believe it can, provided world governments give high enough priority and continuing support to agriculture and forestry. It cannot be achieved with the miserly and discontinuous support that has been given to agriculture and forestry in most countries during the past 50 years.

Du Pont Context: Specifically, what is needed in the developing countries?

Borlaug: The biggest problem is the shortage of trained scientists. Experience, first in Mexico and subsequently confirmed elsewhere, has shown it takes from 15 to 20 years to select and train a sufficient number of top-flight scientists to take over management and effectively operate a national research and extension program.

Massive investments are also needed -- particularly in irrigation, drainage, reforestation, soil conservation and flood control projects, agricultural credit and better marketing infrastructures.

Du Pont Context: Some people are critical of modern farming methods, saying they're "energy hungry." How do you answer that charge?

Borlaug: Agriculture must be assured of sufficient energy to produce the nitrogenous and other fertilizers to restore and maintain soil fertility. Without fertilizers, the world will starve.

It is ironical that many elitists who are enjoying the "good life," with large gas-guzzling automobiles and air-conditioned houses and offices, are questioning whether agriculture can justify using scarce fossil fuel to produce nitrogenous fertilizer for use in the production of more food. They seem to imply that if we geneticists and plant breeders were worth our salt, we would be able to develop varieties of food crop plants that would produce high yields on infertile, impoverished, worn-out soils.

To them, I can only say we will do so about one year after such utopians show me a new race that can develop a strong body, work effectively, wax eloquently and be happy without food.

Du Pont Context: You seem to have little patience with elitists. Why?

Borlaug: Because they appear to give little thought to the effect of their activities on the economy, inflation, and the standard of living of the general public. We bicker and squabble and play games to satisfy the whims or calm the fears of these narrow, special interest groups.

To environmentalists, for example, recreation appears to be more important than the health of the economy. They lobby and succeed in getting a hundred million acres of public lands set aside as recreational wilderness areas, to be used only for backpacking, thereby precluding the land's use either for the production of forest products or minerals. Or they protest against use of agricultural chemicals. If agriculture is denied the use of chemical fertilizers and pesticides, the world will be doomed, not by chemical poisoning but by starvation.

Du Pont Context: What chances does the world have? Can we solve our problems and keep on feeding our ever-increasing population?

Borlaug: As I said, I'm cautiously optimistic. Despite all of today's gloom and doom, we live a longer and better life than all previous generations. But solutions to problems can be synthesized and implemented only by well-informed, clear-thinking minds, with positive points of view. Don't become complacent.

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CAPTION

"The apostle of wheat," Dr. Norman E. Borlaug examines a promising new variety in a test plot.