

*A Reader's Digest*

**REPRINT**

Father of  
the "Green  
Revolution"

BY SCOTT AND KATHLEEN SEEGER



*Reader's Digest*

PLEASANTVILLE, NEW YORK 10570

APPROPRIATELY, the news that he had been awarded the Nobel Peace Prize reached Dr. Norman E. Borlaug last October in a Mexican wheat field, with his sleeves rolled up and his hands full of experimental plants. Surrounded by his Mexican colleagues and young trainees from Africa, Asia, Europe and Latin America, the Iowa-born plant pathologist thought at first that the report was a mistake. Then, convinced that it was genuine, he shoved his ever-present sports hat onto the back of his head and said, "Well, that's great. But we've got work to do now. We'll celebrate later."

It is Borlaug's relentless devotion to work, plus a bold, imaginative approach to scientific problems, that has made him the first agricultural plant scientist ever to receive the coveted Nobel award. His high-yield wheat varieties ended Mexico's decades-old wheat shortage and provided an exportable surplus. His high-yield dwarf wheats brought Pakistan from near-famine to self-sufficiency. This year or next, it will do the same for India's hungry millions. In more than 30 countries in Latin America, in the Middle East and other parts of Asia and Africa, some 25 million acres are planted to this extraordinary grain, feeding an estimated 500 million people. The tremendously increased harvests—in some places, yields of as much as ten times per acre more than older-type wheat—have aptly been called the "Green Revolution."

# Father of the "Green Revolution"

BY SCOTT AND KATHLEEN SEEGER

*This modest American scientist's crusade to improve crop yields has staved off world famine and won him the Nobel Peace Prize*



**Mecca in Mexico.** The man who made the revolution possible heads the wheat research and production project of the International Maize and Wheat Improvement Center. This international organization is financed jointly by the Mexican government, the Ford and Rockefeller foundations, U.S. AID, the United Nations Development Program and the Inter-American Development Bank. Much of the research and training program is carried out in the fertile Yaqui Valley at a research center, which is a division of Mexico's National Institute of Agricultural Research, in northwest Mexico.

Bronzed and 56 years old, Borlaug still weighs a trim 155 pounds, his weight as a champion wrestler at the University of Minnesota. He is a friendly and unassuming man, of infinite patience in showing a young scientist how to identify a promising strain of wheat, of no patience at all with bureaucratic delays or the oversophisticated scholarly research which has no relevance to human needs (this he calls "chasing academic butterflies"). Largely because of his work, the Mexican agricultural research center in the Yaqui Valley is one of the world's largest and best-equipped wheat-experiment stations. Plant geneticists come there by the hundreds each year. "What Mecca is to the Muslims," observed a visiting Muslim scientist, "so is the Yaqui Valley to a wheat breeder."

Norman Borlaug never expected to become mankind's champion against hunger. Born on a 56-acre farm near Cresco, Iowa, he might have been satisfied to graduate from high school and become a farmer, except that his grandfather constantly urged him to go to college. He enrolled in the University of Minnesota, worked his way through with odd jobs. Eventually he got a Ph.D. in plant pathology, and settled down to a comfortable research job with the Du Pont chemical company.

Then, in 1944, the Rockefeller Foundation offered him an unexpected job south of the border. The year before the Mexican government had asked the Foundation to join in an effort to improve production of Mexico's basic food crops. The program's purpose was twofold: to increase crop production and to train young scientists. The Foundation agreed, and a pilot project was launched.

A highly competitive man, Borlaug found a real challenge in Mexico. His first experimental station consisted of 200 currently unused acres in the highlands of Chapingo, about 22 miles northeast of Mexico City. The worn-out earth there produced a niggardly eight bushels of wheat per acre—less than half the average U.S. yield at the time. Convinced by long experimentation that fertilizer was the only solution, Borlaug traveled through the highlands trying to persuade farmers to restore

the soil nutrients with chemicals. At best he met skepticism; at worst, open hostility.

And there were other problems. Soon after he arrived in Mexico, four young trainees were assigned to him. They were aghast at seeing their mentor in work clothes in the fields, pulling up and sorting wheat plants with his own hands. "Dr. Borlaug," they protested, "in Mexico an educated man does not work with his hands."

"It's the only way I know how to work," Borlaug replied. "This wheat will talk to you if you listen, but you can't hear it if you sit under a tree and watch other people do the work." The young men eventually saw that if they handled the wheat and the tools themselves, they learned a great deal more—and faster. They even developed an unorthodox pride in their own sweat-stained work clothes, and took over indoctrinating newer trainees.

**Accomplishing the Impossible.** In 1945, Borlaug roamed the length and breadth of Mexico looking for another area in which to expand wheat production rapidly. He found it in the flat, mountain-ringed Yaqui Valley, where farmers were more prosperous and wheat production was 20 bushels per acre, the highest in the country.

Now Borlaug pioneered a new concept—growing two generations of experimental plants each year. He did it by growing the strains during the winter—the commercial wheat-crop season—in the Yaqui

Valley, then planting a second generation during mid-May at 8600 feet near Toluca.

Textbooks said that this move was impossible. "About once every 25 years they ought to burn all the agricultural textbooks," Borlaug observes. "It takes about that long to disprove or improve on most of what the experts preach as gospel."

In 1948, the first two improved commercial varieties that outproduced any local wheat appeared. The increase was small, and Borlaug was far from satisfied; but the research base had been expanded, and new practices had been developed. From there on, a series of new varieties were obtained. Borlaug's new wheats took over Mexico in the 1950s. Self-sufficiency—one goal of the program—was reached in 1956.

**Pampered Acres.** In the meantime, Borlaug and his team were nurturing another major breakthrough. "In 1953," Borlaug says, "we received from Dr. Orville Vogel, Washington State University scientist, a few seed crosses involving the so-called Norin dwarf, a Japanese wheat. Our first attempts to incorporate the Norin dwarfness into Mexican wheats in 1954 were unsuccessful, since these strains were attacked by rusts and were highly sterile. A second attempt in 1955 brought success, and it became evident that a new type of wheat was forthcoming."

Word of the "miracle" spread rapidly through the highlands, and soon even the toughest old shell-

backs were lining up to buy seed and fertilizer.

From 1961 on, a number of the new dwarf and semi-dwarf varieties rapidly took over the wheat-producing regions in Mexico. The release of the first semi-dwarfs coincided with the fusion of the coöperation program into Mexico's National Institute of Agricultural Research. The program was now put into the hands of Ignacio Narvaez, one of Borlaug's first trainees, and today coördinator of the wheat program in the Middle East.

Borlaug had done what he had set out to do. Still, his colleagues in the Rockefeller Foundation talked him out of simply returning to the United States. Instead, in 1960, they sent him across North Africa and the Middle East on a trip sponsored by the United Nations Food and Agriculture Organization (FAO). On this trip, he felt the impact of mankind's most merciless enemy: the physical hunger of a billion people. In some countries he saw no agricultural scientists at all. In others he saw plant breeders in spotless white coats confining their work to laboratories and a few pampered acres of experimental plantings.

"Anything will grow at an experimental station!" he exploded. "You've got to solve the problem on the worn-out earth of the village farms. That's where the crops come from."

To FAO he suggested an international training program. The Rockefeller Foundation agreed to foot

the bill, and the first group of six young agronomists from India, Pakistan and other countries arrived in Mexico in 1961. Following Borlaug's example, they worked in the fields. Nine strenuous months later, they returned to their home countries, fired by Borlaug's zeal and carrying with them small packets of high-yield dwarf-wheat seed.

**Resistance From Bureaucracy.** Their enthusiasm was quickly dashed. "We know what can be done," a trainee wrote. "But we can't do it because of political realities."

In 1963, when the Indian and Pakistani governments invited Borlaug to inspect their wheat-breeding programs, he learned firsthand about these "political realities." The dead hand of bureaucracy ruled from the top, promotion was by seniority only and frustration seethed in the lower ranks. But the experiments conducted by the young agronomists in India and Pakistan indicated clearly that the "Mexican" wheats showed tremendous potential there, if the governments would commit themselves to producing campaigns based on the new seed.

"You're sitting on a volcano," Borlaug told responsible officials. "When your farmers see what fertilizers and improved seeds will do, they will be after your scalp for failing to develop fertilizer factories and providing credit." The officials countered: "Our small illiterate farmers will not pay higher prices for superior seed, and still more money for fertilizers."

"They may be illiterate," Borlaug retorted, "but they're not dumb. Show a farmer who's been getting seven bushels of wheat per acre that his land will produce ten times that and he won't settle for anything else. We proved that in Mexico."

Fortunately, President Ayub Khan in Pakistan and Minister of Agriculture C. Subramaniam in India supported Borlaug's idea. After much haggling, 300 tons of seed were imported from Mexico to each country in 1965, and hundreds of demonstrations were conducted in both countries. The results were spectacular. In both countries, farmers clamored for seed and fertilizer.

After the 1966 harvest, Minister Subramaniam decided to import 18,000 tons of seed for India, while Pakistan imported 42,000 tons the following year. These seed imports—the largest the world has ever witnessed—set the stage for the green revolution that ensued. Since 1965, wheat production in India has increased from 12.3 million tons to over 20 million tons in 1970. In Pakistan, it soared from 4.6 million tons to more than 8 million tons in the same period.

**Respite From Famine.** Today, other wheat-breeding programs are under way in Turkey, Tunisia, Egypt, Morocco, Iran, Afghanistan, South Africa, Kenya, Latin America, and parts of the United States and Canada. Within a few years, they may put an end to chronic hunger in many of the world's underdeveloped lands.

Meanwhile, the international training program for young scientists has worked so well that in 1964 the Rockefeller Foundation and FAO organized it on a formal scholarship basis as the International Maize and Wheat Improvement Center, with headquarters in Mexico. Every year, the center sends packets of that year's best varieties free to some 70 independent wheat planters and institutions throughout the world, asking in return only that the recipients send detailed notes on results, plus seed samples of their own most promising crosses. "We want to keep the genetic soup bubbling," Borlaug explains.

Borlaug's struggle for scientific acceptance was won long before he was awarded the Nobel Peace Prize. Widely known as "The Apostle of Wheat," he has been honored by several universities and civic organizations, and decorated by the governments of India and Pakistan. He wears these honors lightly, still working as long and hard as when his theories had yet to be proved.

Borlaug considers the success in increasing the world supply of food "only a stopgap, not a solution." The Mexican dwarf wheats, he feels, have given the human race about a 30-year respite from the specter of world famine. But he sees disaster if that breathing spell is not used to get the world's exploding birthrate under control. "Population growth transcends all other problems," he says. "Unless tamed, it will one day wipe us from the earth's surface."