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Obituaries

Norman Borlaug

Agronomist and 'grandfather of the Green Revolution' whose experiments with hybrid wheat strains won him the Nobel Peace Prize

Norman Borlaug has, in the opinion of many experts, saved more human lives than any other individual in history. He was the grandfather of the Green Revolution in which, between 1961 and 1980, wheat crop yields doubled, tripled and sometimes quadrupled around the world. His experiments with hybrid wheat strains and nitrogenous fertiliser created strains of the staple food impervious to pests, bad weather and poor soil, enabling the world to support a far greater human population than many thought possible after the Second World War. Yet his methods and message fell out of favour, to the detriment of millions — especially in Africa.

In the mid-1950s Malthusian doomsayers saw the contrary trajectories of population growth and food production in South-East Asia and the Indian sub-continent and predicted catastrophic worldwide starvation, the densification of forests and the outbreak of an inevitable population crash. The reversal in the Third World's agronomic fortunes was so sudden and so miraculous that many have since forgotten the holocaust forestalled — especially, in Borlaug's view, the tandler sections of the green world which seek to impose organic food and "natural" production methods on the world's poorest countries.

Norman Borlaug was born in 1914, the grandson of Norwegian immigrants, in Souda, near Cresco, Iowa. He worked on the family farm until 19 when he signed up for the National

Youth Administration, one of Franklin Roosevelt's "alphabet agencies" set up to combat poverty and despair during the Great Depression. His commitment secured him a place at the University of Minnesota in 1933, but he ran out of money. He transferred to the College of Agriculture's forestry service and then joined the Civilian Conservation Corps (CCC) and the US Forestry Service. As a group leader with the CCC he was in charge of many recruits who were emaciated and starving, refugees from the great Dust Bowl that had laid waste to the plains of America from Texas to South Dakota. He said: "I saw how food changed them, and this left scars on me."

He completed his degree in forestry in 1937, the year he met Elvin C. Stakman, a pioneer of plant pathology. Borlaug was inspired by Stakman's determination to defeat wheat rust, a parasitic fungus that destroyed thousands of acres of wheat every few years, and resolved to build on his research. He gained his master's degree in 1940 and his PhD in 1942, and was taken on by DuPont laboratories in Wilmington, Delaware.

Borlaug attempted to enlist, but was told that his laboratory was about to be closed. He went to work, for while he was needed. He helped to develop canteen disinfectant, watertight sealants for electronic components and an adhesive gum that could withstand prolonged exposure to salt water. It was used to seal supply crates dumped into the sea for US troops stranded on the coast of Guadalcanal in July 1944. DuPont was allowed to resume commercial activities, but Borlaug,

when to apply himself fully to agriculture, left to enlist on a joint project launched by the Rockefeller Foundation and the Mexican Government. Its aim was to massively boost the country's ailing wheat harvests.

Beginning his work under George Harar, Borlaug worked near Texcoco for ten years in difficult conditions, developing hundreds of hybrid strains. After several fallouts with Harar, resistance from local farmers and a threat of resignation by Borlaug, he persuaded his superiors to try his idea of "shuttle breeding", in which a successful strain harvested in the central highlands of Mexico would be sped north to and Sonora for a second growing season. The idea was a breakthrough; the seeds that Borlaug had cross-fertilised did equally well in both areas, defeating two widely held beliefs: that seeds needed "rest time" to develop and that specific strains had to be developed for each agricultural region.

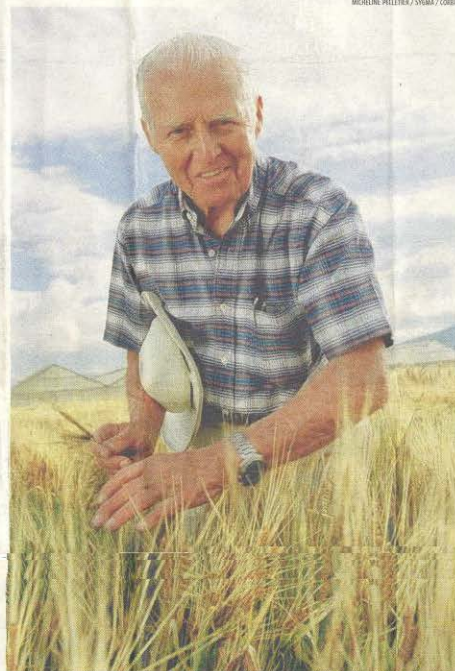
In 1953 Borlaug experimented with a Japanese dwarf variety. Its multiple wheat heads produced high yields, but made poor flour and was highly susceptible to disease. Borlaug hoped to create a hybrid that preserved only the desirable traits, and after many generations of cross-pollination and many disastrous crops he produced a variety that seemed viable. The result was immediate and astonishing: Mexican wheat production, at 1,400 kg per hectare in 1960, exploded to 2,700 kg per hectare in 1963. This was the beginning of the Green Revolution.

In 1965 attempts were made to ship containers of semi-dwarf seeds to India and Pakistan, but war broke out between the two countries shortly after an agreement was reached. When, at last, the grain arrived Borlaug experienced even more local resistance than in Mexico: subsistence farmers were terrified of trusting their next harvest to a scientific experiment. Politicians, quoting widely held scientific belief, opined that the imported seed would introduce foreign pests and disease that would devastate food stocks. Nationalists pointed out that

He confounded those predicting that millions would die of starvation

the new strains had been developed by an American, and newspapers carried the rumour that the new wheat caused sterility. Frustrated at the impasse, the Indian Agriculture Minister Chidambaram Subramaniam dug up his private cricket pitch, planting it and 1,000 other demonstration sites with the new strains. Others followed his example, and India's wheat crop increased from 12 million tonnes in 1965 to 17 million in 1967. That year Pakistan, a country dependent on wheat imports, imported 42,000 tonnes of seeds. It was self-sufficient in seed stocks 12 months later.

Borlaug was awarded the Nobel Peace Prize for his services to food production in 1970. By then, 40 million hectares of land worldwide were being used for semi-dwarf wheat cultivation,



Borlaug: his success in increasing wheat yields "saved millions of lives"

comprising the most productive 10 per cent of the planet's agricultural land. He had confounded doomsayers such as the biologist Paul Ehrlich whose book *The Population Bomb*, published the previous year, predicted that millions would soon die of starvation. The revolution was confounded in Africa, however, first by warfare and political instability, and then by Western environmentalism.

In 1972 use of the pesticide DDT was banned in America, a decade after Rachel Carson's chilling *Silent Spring* was published, and opinion began to turn against the indiscriminate use of chemical pathogens and fertilisers which had been the engine of the Green Revolution. Economists and biologists argued that monoculture made poor populations serfs to corporate landowners and doomed them if their staple crop was destroyed by disease. Others felt that sending vast amounts of chemical fertiliser to Africa would destroy its agricultural traditions for the benefit of Western industrialists. Some have suggested much darker reasons than post-colonial guilt for the withdrawal of the World Bank, the Ford Foundation and the Rockefeller Institute from large monoculture projects in Africa in the early 1980s — not least the global ramifications of a stable,

industrialised, consumerist Africa. In any case the result was that Africa was left with centuries-old crop strains until the Ethiopian famine of 1984-85.

Although the famine owed more to war, drought and government corruption than to archaic production methods, Borlaug was convinced that a world "hungry for bread and for peace" must resolve politics and poverty in tandem. Determined that no such catastrophe should occur again in Africa, Ryoicho Sasakawa, the chairman of the Nippon Foundation, invited Borlaug to oversee a project to supply African farmers with short-strawed, drought-resistant wheat. The first shipments were made to Ghana and Sudan in 1986, the year that Borlaug was made president of the Sasakawa Africa Association (SAA). The scheme gained the support of the former US President Jimmy Carter, but progress in Africa was far more piecemeal than in Asia, and carried out in a very different climate. A broad professional college now held that Borlaug's work was politically, even morally, wrong. Others, shocked by the intransigence of the Marxist Mengistu regime in Ethiopia, were resigned to thinking that an African government really cared whether or not its people starved and therefore anything but re-

He captured a Paris of street urchins and knife grinders

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active charity was doomed to failure. The SAA approached smallholders individually, and the Sasakawa Global 2000 programme operated in ten African countries that showed "a readiness to end hunger" by 2003, reaching four million farmers. Thereafter local difficulties reduced the operation to four countries, and the Green Revolution has yet to truly take hold in Africa.

Borlaug always made clear that advances in yield could buy only breathing space from a disaster that was certain unless the "population monster" was curtailed. In his Nobel lecture of 1970, Borlaug stated: "Most people still fail to comprehend the magnitude and menace of the population monster. The rhythm of increase will accelerate... unless Man becomes more realistic and preoccupied about his impending doom." To Borlaug's dismay, the developed world has since accepted the impending doom, but has tied it to nebulous, untestable, and unquantifiable reasons rather than the world population trends that underpin it. This approach has helped to evangelise the organic food lobby and led to blithe ignorance of the "Borlaug hypothesis", that increasing the productivity of agriculture on the vast lands of the world means necessary — is the only way to preserve what remains of the world's forests and wild places. The Green Revolution continues to be discredited by both serious scientists and conspiracy theorists: in 1991 the eco-feminist Vandana Shiva, director of the Re-

search Foundation for Science, Technology and Ecology in Delhi, published *The Violence of the Green Revolution*, blaming Borlaug's methods for destroying both crop diversity and wider society in India. Resistance continues to mount against biotechnology, which Borlaug saw as the next logical step in the revolution.

In April 2002 Borlaug signed a declaration with several environmental experts, including Patrick Moore, the co-founder of Greenpeace, in favour of "high-yield conservation". The movement against trendy agricultural primitivism has since gained pace, yet the lack of respect paid to Borlaug's teachings in recent years is astonishing in relation to his impact on the human species. Many of those who rubbied and his achievements as a "brown revolution", he said, were Utopians and elitists who had "never experienced the physical sensation of hunger".

He won many international awards, but his own country was slow to give him credit. In July 2007 he was awarded the Congressional Gold Medal, although the wording of the law by which it was awarded sought political mileage from his achievements: "Dr Borlaug has saved more lives than any other person who has ever lived," it stated. "And likely has saved more lives than the Islamic world than any other human being in history."

From 1984 until recently Borlaug taught at Texas A&M University. His wife died in 2007. He is survived by two children.

Norman Borlaug, agronomist, was born on March 25, 1914. He died on September 12, 2009, aged 95