

BOOKS

Left Behind by the Green Revolution

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In the late 1950s, American agronomist Norman Borlaug realized that the disease-resistant strains of wheat he bred under a Rockefeller Foundation-funded program in Mexico could produce high yields in locations ranging from Mexico to Argentina and Kenya to India. Many scientists viewed Borlaug's breeding work with skepticism, holding to the view that crops should be bred in the region where they're grown. But Borlaug convinced the Rockefeller Foundation to use "wide adaptation," which describes a plant variety that produces high yields in a range of environments (also called broad adaptation), as a purposeful breeding strategy for wheat.

The consequences were far-reaching. Borlaug's successful advocacy of wide adaptation as the goal of agricultural research gave a handful of international research centers the opportunity to provide crop varieties to multiple countries across the globe. This opened the possibility of centralizing research efforts like never before. In every country where the new technology was disseminated, international organizations, such as the International Maize and Wheat Improvement Center, or CIMMYT, in Mexico and the Arid Land Agricultural Development program in Lebanon, extended their ambit of operation. They worked with scientists from national organizations,



The Globalization of Wheat: A Critical History of the Green Revolution

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such as the Indian Agricultural Research Institute, to disseminate the new technology at various locations. This was the foundation of what came to be known as the Green Revolution.

Scientist and historian Marci R. Baranski's meticulously researched monograph, *The Globalization of Wheat*, explores the scientific community's interaction with the wheat plant during the Green Revolution years and beyond. Woven around

Borlaug's concept of wide adaptation of wheat plants across agroclimatic zones, Baranski's book details how the idea gained currency among agricultural researchers, how scientists then introduced wheat varieties across the continents, and what social consequences this effort had in India. Her lucid analysis deftly moves through Cold War politics to demonstrate how the Green Revolution was the result of

scientific advances converging with Western political motives, with food production seen as a defense against communism in nonaligned countries such as India. Along with the political exigency, the introduction of the new seeds was facilitated by humanitarian concerns over recurrent droughts in India and a growing debate over the country's population outstripping the food supplies. Baranski contextualizes the predominant scientific ideas on wheat research, with a particular focus on Borlaug's work, within this flow of events. In doing so, she draws readers into a fascinating—yet relatively unexplored—world of crop sciences and its practitioners.

The Green Revolution has been the subject of multiple research monographs in which experts provide in-depth assessments of the social, economic, and environmental impacts of the famed technological package. But a significant blind spot of the current scholarship is that academics have not adequately studied the individual role and perspective of key agricultural scientists, nor have they covered the community's ideational world and its relationship with government and nongovernmental agencies. This is a crucial gap that needs to be bridged to produce more nuanced understanding of concepts such as scale neutrality, innovation, and technological solutions that are often used in reference to techno-scientific knowledge. Baranski's research is important because she critically appraises these key concepts and, in the process, reveals how scientists used the doctrine of wide adaptation to justify overlooking the agroclimatic and socioeconomic diversity inherent to farming. Her book is a notable contribution to the critical histories of the Green Revolution, and she has opened up lesser-known vistas by keeping the scientific community at the heart of her historical analysis.

Apart from the centralization of research—a process underway in India

before Borlaug shared his wheat research from Mexico—that the concept of wide adaptation helped to further, Baranski argues that the implementation of wide adaptation benefitted larger farmers at the expense of smaller and marginal ones. Although the large farmer-centric approach of the Green Revolution's new technological package has been the subject of frequent study, Baranski successfully demonstrates that this shift originated in the concept of wide adaptation and its implementation by scientists through their research.

Wide adaptation was premised on Borlaug's discovery of wheat varieties that could grow at different latitudes and in different seasons, a characteristic called photoperiod insensitivity. But the varieties that Borlaug developed in Mexico required a lot of chemical fertilizer and consistent irrigation. He braided wide adaptation together with the need for high fertility in a way that ignored, Baranski argues, the reality of many farmers around the world who lacked either access to fertilizers or favorable agroecosystems—a significant deficiency that limited small farmers' ability to engage with the new technology.

With this observation, Baranski neatly unfolds an intensely debated issue in Green Revolution studies: the relationship between the technology and small farmers. Baranski focuses on the Green Revolution's consequences for smallholder farmers for two reasons: she believes, first, the agricultural development community has an ethical obligation to correct the deficiencies of the Green Revolution and ensure that future efforts do not further contribute to inequality; and second, smallholder farmers must be engaged to transform the agricultural system to be more sustainable.

For me, the most interesting part of Baranski's research is her focus on wide adaptation from the perspective of social justice. Although the concept of wide adaptation is integral to agricultural research and Green Revolution-related research has explored the social impacts of the technology, little work has been done so far connecting the practices related to wide adaptation with their societal impact. Baranski creatively traces the root causes of the technology's social consequences back to implementation of wide adaptation's grounding philosophy. She makes a convincing case that the concept caused officials and researchers to neglect the problems facing rainfed and dryland agriculture, where smallholder farmers are predominantly located.

In a variety of publications, scientists have presented evidence showing that the widely adapted Mexican semidwarf wheat varieties ("Kalyan Sona" and "Sonalika") were successfully adopted in northern India's fertile and mostly irrigated farmland, but not in south and central India. Fertilizer application remained a problem in these regions, along with a lack of proper analysis of local conditions to test the responses of available varieties. Prominent scientists claimed that "breeding for favorable environments" could produce varieties that would also thrive in unfavorable environments; Indian as well as American and Japanese researchers argued that, as an article in the *Indian Journal of Genetics and Plant Breeding* recounts, "a crop plant which shows adaptive response under non-stress environments could also be able to produce adaptive phenotype under stress environments." However, Baranski asserts that her research supports the finding that "the semidwarf varieties performed well under trial

conditions but worse under average farm conditions”—evidence that Borlaug overlooked in his advocacy for wide adaptation.

This is not to say that the lack of research on dryland conditions was completely ignored; it did become a subject of discussions among scientists. Although the Green Revolution technology of semidwarf wheat varieties failed to address the challenges of dryland agriculture, the Rockefeller Foundation sponsored the establishment of the International Crops Research Institute for the Semi-Arid Tropics in Hyderabad, India, with the sole focus on semiarid crops. The All India Coordinated Research Project on Dryland Agriculture was also established to address similar issues.

Baranski sees an unfortunate continuation of the Green Revolution mindset that left so many farmers behind in many of today's development organizations, including the Alliance for a Green Revolution in Africa, supported by the Bill & Melinda Gates Foundation, and the government of India's Bringing Green Revolution to Eastern India. She argues that these groups are repeating the mistake of taking “a top-down, seed-centric approach to technology development and dissemination.” Their experts, following in the footsteps of development institutions such as CGIAR and the US Agency for International Development, have shown little interest in “low-technology approaches” that could help more people.

Instead of plant breeding, biotechnology, and other capital-intensive technological approaches, Baranski proposes a focus on interventions such as improving farmers' education and supporting infrastructure development. Without such a reorientation

in approaches to international development, she writes, “these organizations will fail to achieve their stated goals of reducing poverty and food insecurity through a technological approach that glosses over the context-specific nature of agriculture.”

The Globalization of Wheat is quite informative about the Green Revolution and its worldwide ramifications. There are, however, certain lingering questions that could have given additional nuance to Baranski's analysis. First, she emphasizes what Borlaug wanted and how he “pushed” for the release of widely adapted wheat varieties in India. The pivotal role of Borlaug is undeniable, but it is equally important to explore the confluence of factors that aligned a huge section of Indian agricultural scientists in favor of wide adaptation. The common tendency is to see the scientific community in alignment with the development goals of the state, but historical analysis needs to examine the professional goals and aspirations that might have influenced scientists to support a particular policy over others. Baranski makes only cursory references to the “political capital” and “personal motivation” of scientists, who mainly came from northwest India, without elaborating on what benefits the scientific community hoped to gain in supporting the state's program of wide adaptation.

Another area I feel the book could have touched on is the effort taken by farmers, mainly ones owning small acreage, to achieve food and nutrition security for themselves. After all, “one of the more positive outcomes” of the Green Revolution, Baranski writes, is that it has taught academics, officials, and development professionals to rethink farmers'

role not as “backward peasants” but as “entrepreneurial agents.” We genuinely need more studies on innovative work undertaken by these entrepreneurs to counter the equity challenges posed by capital-intensive technologies as well as problems such as climate change.

Having said that, I strongly feel that Baranski's book is a very fine example of a work that balances the history of science with science policy studies. It exposes the lacuna in our understanding of India's most talked-about and important agricultural policies. And it delineates what needs to be done to meet the modern challenges of food security without disregarding the interests and realities of small farmers.

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