



FINDINGS ON THE IMPACTS OF CGIAR RESEARCH

1971–2011

The collaborative work of the Consultative Group on International Agricultural Research (CGIAR) has resulted in development impacts on a scale that is without parallel in the international community. They are the result of “international public goods,” including improved crop varieties, better farming methods, incisive policy analysis and associated new knowledge. These products are made freely available to national partners, who transform them into locally relevant products that respond effectively to the needs of rural households in developing countries.

Following are 40 largely quantitative findings on CGIAR impacts since its inception in 1971. Most were gleaned from a 2010 *Food Policy* journal article authored by Mitch Renkow of North Carolina State University in the USA and Derek Byerlee, a former adviser in the World Bank’s Agriculture and Rural Development Department and co-author of the *World Development Report 2008: Agriculture for Development*. The article provides a quite comprehensive overview of hard evidence published in the last decade on CGIAR research impacts.

Much of this impact has resulted from collaborative research on crop improvement, whose products figured so importantly in the Green Revolution and in subsequent efforts to extend the initial gains in agricultural productivity.

- 1** As a result of crop improvement research within and beyond the CGIAR, 65 percent of the total area planted to the world’s 10 most important food crops is sown to improved varieties.
- 2** About 60 percent of the food crop area planted to improved varieties is occupied by many of the approximately 7,250 varieties resulting from CGIAR research.
- 3** A 2008 study put the overall annual economic benefits of CGIAR research on the three main cereals alone at about US\$0.8 billion for maize, \$2.5 billion for wheat and \$10.8 billion for rice in Asia alone, far exceeding the investment in this work.

- 4 For these three crops, research on genetic improvement has made possible rates of yield growth that vary in recent years from 0.7 to 1 percent annually.
- 5 According to a 2008 study on potato improvement, varieties originating from the CGIAR are now planted to more than 1 million hectares, double the area documented just 5 years before.
- 6 The estimated rates of return on the CGIAR's investment in all crop improvement research range from 39 percent in Latin America to more than 100 percent in Asia and in the Middle East and North Africa.

For small-scale farmers, the appeal of improved crop varieties lies not just in their higher yields but in their resistance to diseases and pests and their adaptation to physical stresses like drought, traits that translate into more stable yields over time.

- 7 Recent research documents a steady decline in the variability of maize and wheat yields over the last 40 years, which is statistically associated with the spread of more stress-resistant varieties.
- 8 More stable maize and wheat yields generate benefits with an estimated annual value of US\$149 million and \$143 million, respectively, more than the total amounts spent annually on maize and wheat breeding for the developing world.
- 9 Research aimed at maintaining resistance to a single major disease of wheat — leaf rust — generated benefits from 1973 to 2007 that are currently worth \$5.4 billion.
- 10 A 2009 study aimed at quantifying benefits from CGIAR research on yield stability estimated that the global economic value of genetic resistance to various wheat diseases amounts to as much as \$2.0 billion annually.

Diseases also pose a major threat to livestock production. Solutions, such as vaccines, are now being rolled out and could generate large impacts.

- 11 The production and delivery of a vaccine for East Coast fever — a tick-transmitted disease that threatens some 25 million cattle in 11 countries of eastern, central and southern Africa — is being placed in the hands of private sector partners. It is expected to save more than a million cattle, with benefits worth up to US\$270 million a year in the countries where the disease is now endemic.

As the impacts of climate change emerge, including more frequent and severe drought and flooding, CGIAR crop improvement research is developing new and more resilient generations of cereal varieties:

- 12 More than 50 new varieties with drought tolerance have been adopted on a total of about 1 million hectares across eastern and southern Africa, giving an average yield advantage of 20-50 percent. A 2010 study projects that further adoption of these maize varieties could boost harvests in 13 African countries by 10-34%, generating up to US\$1.5 billion in benefits for producers and consumers.

- I3** A novel approach to seed dissemination has put a new rice variety in the hands of 100,000 Indian farmers within one year after its release in 2009. The new variety offers a yield advantage of 1 ton per hectare, even if submerged for 2 weeks, making it an attractive option for India's 12 million hectares of flood-prone agricultural land.

A landmark 2003 study on the impact of crop improvement research from 1965 to 1998 painted a counterfactual scenario of what the global food system would be like without CGIAR research. It concluded that:

- I4** Developing countries would be producing 7-8 percent less food.
- I5** Their cultivated area would be 11-13 million hectares greater at the expense primary forests and other fragile environments.
- I6** Their per capita food consumption would be 5 percent lower, on average.
- I7** Some 13-15 million more children would be malnourished.
- I8** The study also noted that for every US\$1 dollar invested in CGIAR research, \$9 worth of additional food is produced in developing countries.

Precisely because major impacts can be realized only through collaborative research, the CGIAR has made a considerable effort over the years (accounting for roughly 20 percent of its expenditures) to strengthen the capacity of national partners through formal and informal training as well as other learning activities.

- I9** An estimated 80,000 professionals have received such training so far. According to an external evaluation carried out in 2006, this work is highly relevant to national capacity needs and of high quality, judging from the results of trainee surveys. Evidence from seven country case studies suggests that CGIAR training is a "significant contributor to positive outcomes from research."

In addition to improving all of the world's major food crops, CGIAR researchers have achieved, for the first time ever, dramatic productivity gains in a tropical food fish.

- 20** Selective breeding of the Nile tilapia resulted in a highly productive strain that grows faster and survives better than local ones, offering yields that are 25 to nearly 80 percent higher in the five Southeast Asian countries where the "super tilapia" was introduced and evaluated during the mid-1990s. In all of these countries, the new strain has generated additional income and employment on both large- and small-scale fish farms, while lowering market prices by about 10 percent and thus benefiting consumers significantly. In the Philippines alone, increased employment in the tilapia industry has benefited 300,000 people.

A large amount of evidence compiled since the 1990s indicates that gains in developing country food production have contributed importantly to poverty reduction by raising farm incomes, creating employment for farm workers, reducing the price of food and fueling economic growth.

21 A 2007 study showed that CGIAR research on rice enabled more than 6.75 million Chinese to escape poverty between 1981 and 1999, primarily as a result of lower grain prices made possible by increased crop production.

22 The poverty reduction numbers for India are even more impressive — 14 million people moved out of poverty between 1991 and 1999.

Several studies published in recent years have documented the impacts of the CGIAR as a whole either at the global level or in specific regions.

23 The economic benefits of the CGIAR as a whole were estimated to range from about US\$14 billion to more than \$120 billion. Even under quite conservative assumptions, the benefits of research have been roughly double the investment.

24 A 2007 review of investments in agricultural research carried out by five CGIAR Centers and their partners in South Asia during the post-Green Revolution period (i.e., since the early 1980s) found average annual benefits of more than \$1 billion from research on maize, rice and wheat alone, far above the CGIAR's total annual expenditures in the region.

CGIAR research has had less impact in Africa than in Asia, but work in the former region began a decade later and under quite difficult conditions. Even so, a number of impact studies suggest that African agriculture can produce successes on a par with those unfolding elsewhere, delivering large returns on the CGIAR's significant investment in the region.

25 In the late 1980s, Africa witnessed one of the CGIAR's most spectacular research achievements since the Green Revolution — biological control of two devastating insect pests of the tropical root crop cassava. The economic returns — reaching a current value US\$9 billion for research on just one of the pests, the cassava mealybug — far exceed the CGIAR's total investment in Africa since 1971.

Crop research has yielded important results in Africa as well.

26 As a result of maize improvement in West and Central Africa from 1971 to 2005, farmers are planting improved varieties, derived mostly from CGIAR research, on about 60 percent of the total maize area, with economic benefits estimated at \$2.9 billion annually.

27 Improved varieties of cowpea, which provide both food and livestock feed, are being widely adopted in the dry savannas of West Africa, with estimated benefits of \$299 million to \$1.1 billion expected to accrue during 2000-2020.

28 Impressive gains have also been registered in Eastern and Southern Africa, where improved varieties of common bean, developed with farmer participation, have been adopted on about 50 percent of the total bean area over about 15 years, according to a 2008 study. It estimates that the new varieties are strengthening food security and raising incomes in 5.3 million rural households. The benefits of bean improvement research for Africa are estimated to have a current value of roughly \$200 million, compared to costs of about \$16 million.

29 New Rice for Africa, or NERICA, which combines the high yields of Asian rice with African rice's resistance to local pests and diseases, has spread to about 250,000 hectares in upland areas, helping reduce national rice import bills and generating higher incomes in rural communities.

30 Recent research has also begun to document nutritional benefits from improved crop varieties. In Mozambique, the introduction of new orange-fleshed sweet potato significantly increased the intake of vitamin A among young children in 850 households, according to a 2007 study.

The results of CGIAR research on natural resource management have proved harder to implement and evaluate than its work on crop improvement. Nonetheless, a set of seven case studies published in 2007 indicates that this research is giving highly positive returns on investment, based just on the benefits for agricultural productivity. If methodologies were available for gauging the environmental benefits as well, the returns would no doubt be much higher.

31 The practice of no-tillage, which is spreading rapidly in the rice-wheat systems of South Asia's Indo-Gangetic Plain, has been shown to reduce farmers' production costs by 10 percent and to raise crop productivity by the same amount, generating economic benefits on the order of US\$165 million since 1990. This does not include the substantial environmental gains resulting from the conservation of water, sequestration of carbon in the soil and reduction of greenhouse gas emissions.

32 By 2002, more than 66,000 farmers in Zambia had adopted an agroforestry system called "fertilizer tree fallows," which renews soil fertility using on-farm resources. The system has been shown to boost maize production while reducing production risks and soil erosion, with benefits of up to \$20 million, compared with an investment of about \$3.5 million.

33 In Malawi, an integrated agriculture-aquaculture system, introduced during the mid-1990s with active farmer participation at a cost of \$1.5 million, has created benefits worth nearly \$3.5 million by doubling the income of rural households and dramatically increasing fish consumption. The system shows great promise for other areas of southern Africa where the agricultural labor force has been devastated by HIV/AIDS.

34 New information and tools provided to conservationists during the 1990s is being used to monitor some 37 million hectares of forest globally, resulting in better management of this diminishing resource and contributing to more sustainable livelihoods for forest dwellers.

Development impact depends not just on new technologies but on better policies that offer rural people the means and incentives to invest in sustainable agricultural production and resource use. While hard to measure, the impacts of CGIAR policy research and advocacy appear to be substantial, as suggested by recent case studies indicating benefits worth millions of dollars.

35 Research on the liberalization of rice prices in Vietnam during the mid-1990s led to the relaxation of rice export quotas and of internal restrictions on trade, generating benefits worth US\$45-91 million.

- 36** A food-for-education program in Bangladesh, catering to 2.1 million students in 17,811 schools, created total benefits estimated at \$248 million, with the aid of capacity building and policy research, which guided the conception, evaluation and targeting of the initiative starting in the early 1990s.
- 37** Recent work on the political economy of Indonesia's pulp and paper sector has given rise to more sustainable production practices, more effective regulation and other interventions, with benefits totaling \$19-21 million.
- 38** Shifts in Syria's policies on fertilizer distribution and barley prices in arid zones starting in the mid-1980s have contributed to increased barley output through more efficient fertilizer use, leading to improved livestock nutrition, with benefits worth \$73.4 million.
- 39** Research and advocacy aimed at decriminalizing the marketing of milk by small-scale vendors in Kenya created benefits for producers and consumers having an estimated value of \$44-283 million.
- 40** In the Philippines, improved policies on pesticides — starting in the late 1980s and involving the regulation of highly toxic products on rice and the training of rural health officers — has resulted so far in benefits valued at \$117 million.



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