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A Good Global Investment for Europe

How investing in CGIAR reduces global poverty and benefits EU farmers, businesses and consumers

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CGIAR investments have delivered substantial economic benefits for the EU while reducing global poverty and food insecurity. CGIAR has boosted productivity on EU farms, expanded export markets, and made food more affordable for EU consumers. It has also helped prevent potential damage from pests and diseases that threaten EU farm livelihoods. This note quantifies the benefits to farmers, exporters and consumers.

CGIAR is an international network of 15 agricultural research centers with more than 9,000 scientists across the world working towards a food-secure future for all. CGIAR's work is focused on lower-income countries where food security is particularly at risk and where the benefits of its work are substantial. By 2020, CGIAR science, especially crops bred for higher yields and resistance to pests and diseases, had been introduced across more than 544 million acres of agricultural land in Asia, Africa, and Latin America, creating €40.1 billion in direct annual economic benefits[1] and even greater indirect effects.[2]

CGIAR's work also brings benefits to the EU. CGIAR innovations, although developed for lower-income countries, have increased productivity for EU farmers and helped protect their livelihoods from tropical pests and diseases. Increased production of food globally has increased the availability of food and reduced the cost of a healthy diet for EU consumers. CGIAR's work on improving resilience is protecting future food supply chains for EU consumers. The increase in income made possible by CGIAR work in lower-income countries has increased demand for goods and services exported from the EU. This brief documents how CGIAR's work has contributed to higher yields and protection from pests for EU farmers, growth in EU exports, and improved affordability of food for EU consumers.

Farmers

Current productivity

CGIAR crop technologies directly benefit EU farmers. About 63 percent of wheat grown in Europe can be traced back to CGIAR breeding material containing important genetic characteristics such as dwarfing that significantly reduces plant height, leading to improved lodging resistance, increased yield and resistance to pests and diseases including wheat rusts.[3]

The impact of CGIAR varieties on wheat production is substantial. The result is wheat varieties that enable EU farmers to produce an additional 3.5 million tonnes of wheat per year, valued at € 1.2 billion annually, with additional benefits accruing from the prevention of losses to pests and diseases.[4] Table 1 presents additional estimates of the benefits for EU countries based on the share of CGIAR varieties in wheat production.

The production gains increase further when other CGIAR crop varieties are also taken into account. If we also consider CGIAR breeding of other crops such as barley (which accounts for the 2[nd] largest cultivated area among EU countries after wheat), corn, rice, sorghum, legumes, and fodders,

[1] Fuglie, K., Echeverria, R. 2024. The economic impact of CGIAR-related crop technologies on agricultural productivity in developing countries, 1961–2020. *World Development*, *176*, 106523.

[2] Gollin, D., Hansen, C.W., Wingender, A.M. 2021. Two blades of grass: The impact of the green revolution. *Journal of Political Economy, 129*(8), 2344-2384.

[3] Lewis, C.M., Persoons, A., Bebber, D.P., Kigathi, R.N., Maintz, J., Findlay, K., Bueno-Sancho, V., Corredor-Moreno, P., Harrington, S.A., Kangara, N., Berlin, A. 2018. Potential for re-emergence of wheat stem rust in the United Kingdom. *Communications Biology, 1*(1), 13.

[4] See Box 1 for the methodology used to calculate these impacts. Throughout, benefits are calculated in USD and converted in EUR

the benefits to EU farmers are even larger in absolute monetary terms. For example, barley varieties of CGIAR origin contribute an additional € 93 million per year to EU production.[5]

Table 1. Contribution of CGIAR wheat varieties to production for EU countries

	Additional annual production from CGIAR wheat varieties	
	Thousand tonnes	**Value (millions € per year) 2025 prices**
Austria	49	13.5
Belgium & Luxembourg	57	14.6
Bulgaria	141	71.4
Croatia	17	4.4
Cyprus	--	--
Czech Republic & Slovakia	194	80.7
Denmark	145	63.1
Estonia	5	1.5
Finland	22	11.8
France	994	301.4
Germany	661	218.5
Greece	41	8.8
Hungary	122	83.9
Ireland	13	4.1
Italy	238	70.3
Latvia	16	4.8
Lithuania	46	13.2
Malta	0.1	0.03
Netherlands	34	11.0
Poland	312	108.4
Portugal	2	0.7
Romania	206	57.0
Slovenia	3	0.9
Spain	141	33.1
Sweden	100	33.2

Source: Authors' estimations. See Box 1 for methodology.

Future productivity

Evidence suggests CGIAR crop varieties will contribute to future productivity growth and climate adaptation for European farmers. CGIAR is an important provider of crop genetic material to EU countries, and these materials are critical to improving future yields and output on EU farms, which translates into greater farmer profitability and affordability for consumers. While data are not available for the entire EU, data on accessions are available for 11 countries and demonstrates the prevalence of accessions directly provided by CGIAR.[6] At least 11,203 accessions held across EU-country genebanks have been directly provided by CGIAR centers including about 2,500 barley varieties, 3,000 wheat varieties and 4,500 legume varieties. More than half of these (5,872) were provided during the past three decades.

[5] See Box 1 for methodology used to calculate impacts on barley production.

[6] These estimates are compiled by the authors from GENESYS data and data from national gene banks. Additional notes and a detailed breakdown are provided in Box 2.

CGIAR is one of the main providers of genetic material to the EU. For 11 EU countries for which CGIAR donations of germplasm are explicitly recorded, such donations have accounted for 22 percent of legume accessions, 6 percent of forage crop accessions, 14 percent of barley accessions, 8 percent of wheat accessions, and 7 percent of other grains[7] accessions since 1995. While substantial, these are conservative estimates of the CGIAR genetic material in these gene banks since many varieties from other sources were themselves developed using CGIAR varieties.

Additionally, EU countries have received many accessions of key crops from regions where CGIAR-related varieties for these crops have been widely adopted. According to Fuglie & Echeverria (2024), some or all of Asia, Africa South of the Sahara (SSA), Middle East & North America (MENA), Latin America and the Caribbean (LAC) and Oceania regions have generally had higher adoption rates of CGIAR-related varieties of barley, beans, rice and wheat, since the late 20th century, exceeding 10 percent and often reaching 30 percent or more.[8] The shares of newly registered accessions originating from these high-adopting regions have, on average, accounted for around 10 ~ 20 percent (albeit with fluctuation depending on the periods) of all newly registered accessions in the EU countries since the 1960s, including in recent decades (Figure 1). These patterns suggest that CGIAR-developed ancestor genes continue to account for important shares of breeding resources for these crops in the EU countries, and many of which are likely to end up in varieties used by EU farmers.

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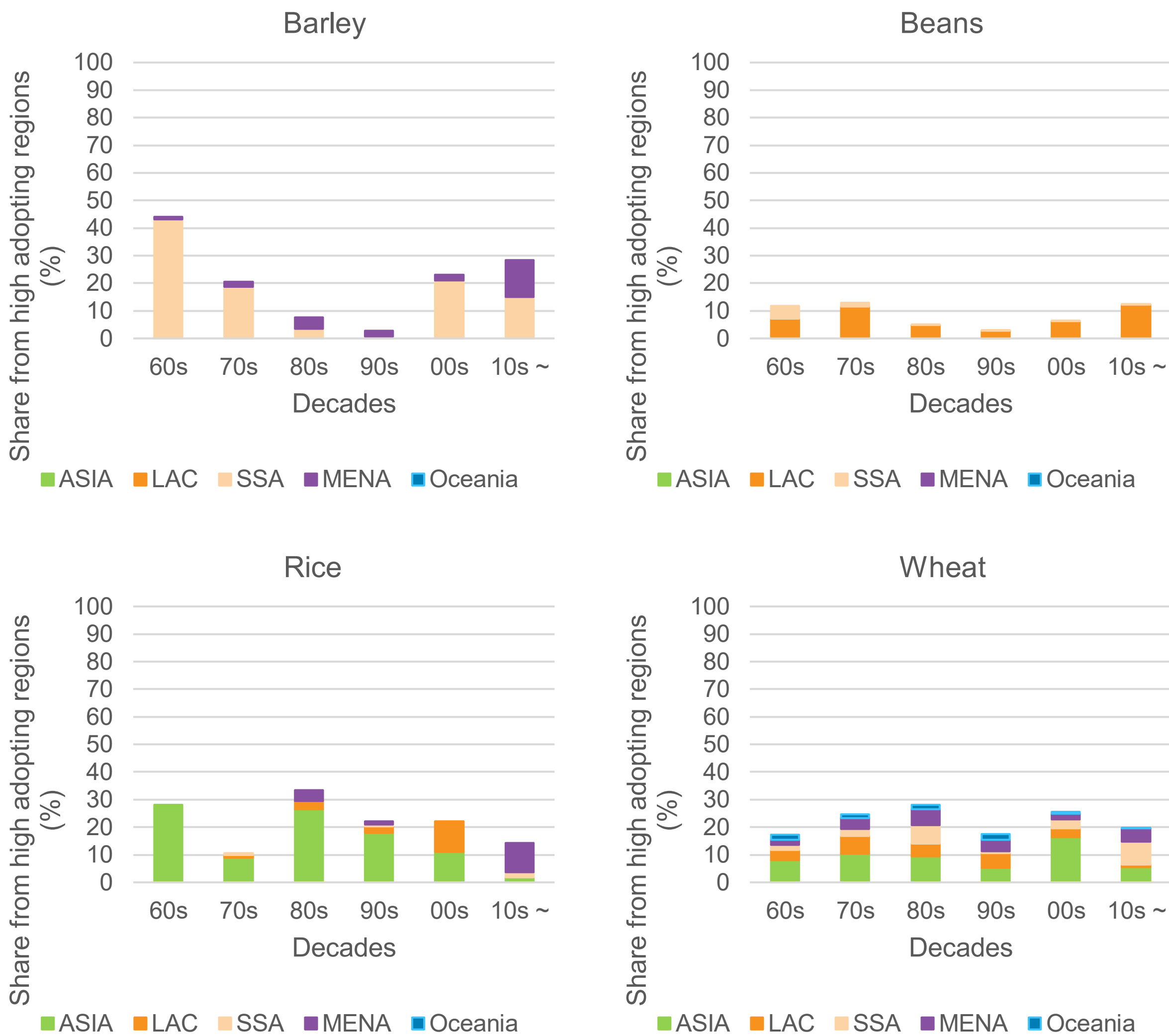
[7] Including maize, rice, sorghum and triticale.

[8] Fuglie, K. O., Echeverria, R. G. 2024. The economic impact of CGIAR-related crop technologies on agricultural productivity in developing countries, 1961–2020. World Development, 176, 106523.

Figure 1. Historical shares of accessions newly registered in EU-country gene banks, originating from each of high-adopting regions, by 10-year periods (%)



Source: Authors' compilations based on GENESYS data.

These genetic materials will be essential to the discovery and development of new productivity-enhancing traits that benefit EU farmers and increase profitability in the face of worsening climate change. CGIAR has developed a range of tools and technologies that benefit the EU wheat improvement agenda, in addition to the genetically diverse elite germplasm novel trait sources described above and used by EU research centers, universities, and companies. In the future, CGIAR is likely to remain a major source of foreign crop genetic material for EU breeding programs in European universities and companies.

Protection from transboundary zoonotic diseases

CGIAR investments safeguard EU food production by monitoring and preventing transboundary zoonotic diseases such as Foot-and-Mouth Disease and Avian Influenza. These illnesses pose major risks to livestock, with outbreaks carrying enormous costs. For example, in 2025 Germany's first Foot-and-Mouth Disease outbreak in over 40 years caused more than €1 billion in damages. Similarly, diseases such as Avian Influenza, which can be transmitted from wild to domestic birds, are highly pathogenic. When transmitted to the poultry industry, birds often die quickly; requiring extensive quarantine and culling to contain disease spread. As a result, Avian Influenza outbreaks can have devastating impacts on the national poultry industry, costing the EU economy billions of dollars in addition to raising prices of eggs and poultry.[9] Because such diseases often spread across borders, prevention requires international monitoring and cooperation. CGIAR research with distributed agricultural research stations across the Global South has modelled the potential impact of this disease and developed insights for its containment, including through vaccination in low-income countries that could serve as the origin of influenza strain.[10, 11, 12]

African Swine Fever (ASF) is another disease CGIAR centers work to contain. In 1978, CGIAR's Technical Advisory Committee requested CGIAR research to contain ASF that had by then appeared in Latin America, including to prevent its spread to developed countries.[13] The International Livestock Research Institute (ILRI) leads CGIAR's ASF research, focusing on monitoring and containment in Africa and Asia. ILRI also collaborates with US and European institutions and private partners to develop and scale a vaccine using CRISPR genome editing technology, as ASF currently has no cure.[14] Investments in this area generate large returns: a recent study found that every €1 invested in a One Health approach—central to ILRI and CGIAR's work—yields €5 by improving the health of both people and livestock.[15]

Exports

CGIAR research has contributed to rising incomes in low- and middle-income countries, which has increased demand for EU consumer goods. Norman Borlaug was awarded the Nobel Peace Prize and Congressional Gold Medal for his work with CGIAR, which sparked a period of rapid growth in agricultural productivity, crop yields, and food security known as the Green Revolution. The overall income gain from this innovation between 1965 and 2010 is estimated at €70.9 trillion, equivalent to almost one year of GDP in today's world.[16] CGIAR accounts for 9 percent of total agricultural investments and can be credited with 9 percent of this increase.

The impact of this income growth on demand for EU exports has been substantial. Estimates indicate that CGIAR investments result in an additional €23 billion in annual exports for the EU Table 2

[9] Opata, M.R., Lavarello-Schettini, A., Semenza, J.C. 2025. Predictiveness and drivers of highly pathogenic avian influenza outbreaks in Europe. Sci Rep 15, 20286. https://doi.org/10.1038/s41598-025-04624-x

[10] Vuong N. Bui, Oguzie, J.U., Tung D. Dao, Anh N. Bui, Son D. Tran, Quy D. Nguyen, Hung Q. Nguyen, Trujillo-Vargas, C.M., Marushchak, L.V., Thang Nguyen-Tien, Shittu, I., Hung Nguyen-Viet, Phuc Duc Pham, Huy C. Nguyen, Brooks, J.S. and Gray, G.C. 2025. Active surveillance for emerging influenza A viruses – Findings from a One Health study in Vietnam's live bird markets. International Journal of Infectious Diseases 108132.

[11] Gilbert M, Xiao X, Robinson TP. 2017. Intensifying poultry production systems and the emergence of avian influenza in China: a 'One Health/Ecohealth' epitome. Arch Public Health. doi: 10.1186/s13690-017-0218-4. PMID: 29209498; PMCID: PMC5702979.

[12] Diao, Xinshen. 2011. Economywide impact of Avian influenza in Ghana: A dynamic computable general equilibrium (DCGE) model analysis. International Journal of Livestock Production 2(10):145-158. https://doi.org/10.5897/IJLP.9000008

[13] Technical Advisory Committee Twentieth Meeting, 20-22 September 1978. Report https://cgspace.cgiar.org/bitstreams/e716f22f-2140-44a9-8377-902cc6bb8773/download

[14] Slater, A. February, 2024. A vaccine solution for African swine fever is within reach. ILRI News. https://www.ilri.org/news/vaccine-solution-african-swine-fever-within-reach

[15] Grace, D. 2014. The business case for One Health. Onderstepoort Journal of Veterinary Research 81(2), Art. #725, 6 pages. http://dx.doi.org/10.4102/ojvr.v81i2.725

[16] Gollin, D. Hansen, C. W. Wingender, A. M. 2021. Two blades of grass: The impact of the Green Revolution. Journal of Political Economy, 129(8), 2344-2384.

shows the breakdown of these benefits across EU countries based on their share of total EU exports.[17] These include €1.3 billion in EU agrifood exports (Table 3), industrial equipment and consumer goods, as well as EU expertise in financial and technical services. Box 1 details how the impact on EU exports was estimated. CGIAR's food systems research continues to support economic development and income growth in low- and middle- income countries, ultimately supporting these positive spillovers for EU exporters.

Table 2. Change in total annual exports of goods and services from broader economic development in LMICs induced by CGIAR R&D

Country	Change in value of exports (millions)	Country	Change in value of exports (millions)	Country	Change in value of exports (millions)
Austria	€ 886	Germany	€ 3,152	Netherlands	€ 1,870
Belgium	€ 1,661	Greece	€ 237	Poland	€ 1,112
Bulgaria	€ 166	Croatia	€ 113	Portugal	€ 381
Cyprus	€ 64	Hungary	€ 555	Romania	€ 367
Czechia	€ 846	Ireland	€ 1,221	Slovakia	€ 383
Denmark	€ 523	Italy	€ 2,611	Slovenia	€ 157
Spain	€ 1,824	Lithuania	€ 129	Sweden	€ 872
Estonia	€ 78	Luxembourg	€ 345		
Finland	€ 374	Latvia	€ 67		
France	€ 3,098	Malta	€ 62		

Source: Authors' estimations based on global model simulations. See Box 1 for methodology.
Note: Results shown for Germany were modelled separately.

Table 3. Change in annual agrifood exports of goods and services from broader economic development in LMICs induced by CGIAR R&D

Country	Change in value of agrifood exports (millions)	Country	Change in value of agrifood exports (millions)	Country	Change in value of agrifood exports (millions)
Austria	€ 37	Germany	€ 49	Netherlands	€ 218
Belgium	€ 114	Greece	€ 20	Poland	€ 88
Bulgaria	€ 13	Croatia	€ 6	Portugal	€ 21
Cyprus	€ 1	Hungary	€ 28	Romania	€ 21
Czechia	€ 23	Ireland	€ 49	Slovakia	€ 8
Denmark	€ 62	Italy	€ 141	Slovenia	€ 5
Spain	€ 157	Lithuania	€ 15	Sweden	€ 24
Estonia	€ 4	Luxembourg	€ 3		
Finland	€ 6	Latvia	€ 7		
France	€ 203	Malta	€ 1		

Source: Authors' estimations based on global model simulations. See Box 1 for methodology.
Note: Results shown for Germany were modelled separately.

[17] Except for Germany, which was modelled separately.

In addition to a general increase in exports, CGIAR develops markets for agricultural technologies in lower income countries, creating export opportunities for EU agricultural technology and equipment businesses. While markets for improved crop varieties, fertilizer, pest management, and mechanized agricultural products are well-established across the EU and other high-income regions, there is significant potential for growth in other parts of the world. CGIAR works with private businesses and governments to develop agricultural innovations, fit them to context, and facilitate their adoption in low- and middle-income countries. For example, ILRI is partnering with France-based Ceva Santé Animale to establish an Animal Health Innovation Hub in Nairobi. [18] The hub seeks to cut the € 7.5 billion in annual livestock losses across Africa with vaccines, surveillance tools, and digital solutions, facilitating the expansion of Ceva Santé Animale into this market.

CGIAR investments continue to support economic development and income growth in lower income countries, contributing to this driver of export growth. There is significant potential for future growth in exports to Africa, where much of CGIAR research is focused and where the population is expected to double by 2070.[19] For example, from 1999 through 2019, agricultural imports to African countries from outside the region grew by 7.4 percent annually.[20] As incomes have risen and the population grows faster than in any other region, imports of a wide range of consumer goods will likely increase, presenting opportunities for EU businesses. Recent analysis suggests strengthening trade between the two continents will promote economic growth in both.[21] By working to raise incomes and develop value chains in this and other regions, CGIAR supports this growth for the EU.

Consumers

CGIAR investments make food more affordable for EU consumers. CGIAR research has increased global food production which has made healthy and nutritious foods more accessible and less costly in the EU. Estimates suggest that CGIAR investments have reduced the cost of a healthy diet in the EU by 1.4 percent, about € 52 per year for a family of four, and increased the amount of dairy, fruits and vegetables consumed by EU families. This was estimated using the same method as the impacts of CGIAR's work on exports (Box 1).

CGIAR research helps to address food production challenges in LMICs brought on by climate change and biodiversity loss, which protects EU food and agriculture imports. At least half of EU imports of maize, rice, wheat, cocoa, coffee, and soy come from countries where climate change and biodiversity loss are negatively impacting production.[22] Climate change produces extreme weather, such as droughts or floods, which threatens crop yields including 13.4 percent of maize consumed in the EU. Similarly, biodiversity loss weakens natural processes that enrich soils, prevent erosion, and

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[18] Dozol, D. April 2025. Ceva and ILRI sign MoU to establish Animal Health Innovation Hub for Africa. ILRI News. https://www.ilri.org/news/ceva-and-ilri-sign-mou-establish-animal-health-innovation-hub-africa

[19] Van Teutem, S. 2024. The UN projects that Africa's population will double by 2070. Data from UN World Population Prospects 2024. Our World In Data. https://ourworldindata.org/data-insights/the-un-projects-that-africas-population-will-double-by-2070

[20] Farris, J., Morgan, S., Johnson, M. 2023, February 6. Market opportunities expanding for agricultural trade and investment in Africa. Amber Waves. USDA-ERS website.

[21] Mendoza, J.F., Stehrer, R. 2025. Africa's trade with Europe: Trends, status and potential developments. Policy Brief No. 65, Federal Ministry Labour and Economy Republic of Austria. https://www.fiw.ac.at/wp-content/uploads/2025/01/65_FIW_PB-EU-Africa_2025-01-08_final.pdf

[22] Hyslop, C., Workman, M. 2025. Climate and Biodiversity risks to EU food imports. Foresight Transitions. https://www.preventionweb.net/quick/94490

regulate water, pests, and diseases.[23] This trend, compounded by climate change, threatens production of cocoa and over €40 billion in the EU chocolate industry among other major food markets.[24]

CGIAR centers work with producers and governments around the world to build climate resilience and reduce biodiversity loss. Climate change is projected to slow food production growth by 8 percentage points between 2010 and 2050, leaving an additional 70 million people at risk of hunger when compared to a future scenario without climate change.[25] Biodiversity loss will worsen these impacts, by inhibiting ecosystem services and natural resilience to climate shocks. CGIAR centers actively work around the world to protect biodiversity and build climate resilience in food systems. Between 1961 and 2015, the adoption of improved crop varieties developed by CGIAR and other sources reduced agricultural land expansion protecting an estimated 16 million hectares of natural habitat, and prevented the extinction of over 1000 species.[26] In another example, the CGIAR Nature-Positive Solutions Initiative worked in five countries to develop and implement strategies for better natural resource management, restoration of degraded lands, and leveraging ecosystems services to increase productivity sustainably.[27] These initiatives benefit growers in LMICs along with EU consumers by cultivating resilience in food systems and mitigating future shocks from environmental damage.

More efficient and healthy production of bananas, cacao and coffee has direct benefits for EU consumers. In 2023, the EU imported more than 5.1 million tonnes of bananas,[28] 1.6 million tonnes of cacao beans,[29] and 3.2 million tonnes of coffee[30] largely from countries where CGIAR works. CGIAR is actively involved in developing and promoting disease-resistant solutions for bananas,[31] cacao,[32] and coffee.[33] This benefits European consumers by ensuring stable production and preventing potential price spikes brought on by disease outbreaks.

CGIAR enables countries to adopt science-based standards and regulations that align with EU regulatory best practices. Food safety and environmental standards introduced in the EU significantly impact food trade, production and policies in LMICs. CGIAR centers work with producers and governments in these countries to implement standards and supporting policies. For example, researchers developed an innovation bundle to test coffee quality and share results with farmers in Honduras using a

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[23] Hyslop, C., Workman, M. 2025. Climate and Biodiversity risks to EU food imports. Foresight Transitions. https://www.preventionweb.net/quick/94490

[24] Hyslop, C., Workman, M. 2025. Climate and Biodiversity risks to EU food imports. Foresight Transitions. https://www.preventionweb.net/quick/94490

[25] IFPRI. 2022. Projections From IFPRI's Impact Model: Climate Change and Food Systems. In 2022 Global food policy report: Climate change and food systems. Washington, DC: IFPRI. https://doi.org/10.2499/9780896294257

[26] U.L.C. Baldos,A. Cisneros-Pineda,K.O. Fuglie, & T.W. Hertel, Adoption of improved crop varieties limited biodiversity losses, terrestrial carbon emissions, and cropland expansion in the tropics, Proc. Natl. Acad. Sci. U.S.A. 122 (6) e2404839122, https://doi.org/10.1073/pnas.2404839122 (2025).

[27] CGIAR Research Initiative on Nature-Positive Solutions. 2024. Annual Technical Report 2023: CGIAR Research Initiative on Nature-Positive Solutions. Montpellier, France: CGIAR System Organization. https://hdl.handle.net/10568/141649

[28] World Integrated Trade Solution. Accessed September 2025. European Union Bananas, including plantains, fresh or dried imports by country in 2023. World Bank. https://wits.worldbank.org/trade/comtrade/en/country/EUN/year/2023/tradeflow/Imports/partner/ALL/product/080300

[29] World Integrated Trade Solutions. Accessed September 2025. European Union Cocoa beans, whole or broken, raw or roasted imports by country in 2023. World Bank. https://wits.worldbank.org/trade/comtrade/en/country/EUN/year/2023/tradeflow/Imports/partner/ALL/product/180100

[30] Government of the Netherlands. 2025. What is the demand for coffee on the European market?. Market information. https://www.cbi.eu/market-information/coffee/what-demand

[31] The Alliance of Bioversity International and CIAT. 2024, July 3. *Bringing diverse bananas to market*. CGIAR News. https://www.cgiar.org/news-events/news/bringing-diverse-bananas-to-market/?utm_source=chatgpt.com

[32] Ocampo-Ariza, C., Müller, S., Yovera, F., Thomas, E., Vansynghel, J., Maas, B., Steffan-Dewenter, I., Tscharntke, T. 2025. Cacao grafting increases crop yield without compromising biodiversity. Journal of Applied Ecology, Online first paper (2025-01 -19). https://doi.org/10.1111/1365-2664.14851

[33] Avelino, J., Romero-Guardian, A., Cuellar-Cruz, H., Declerck, F.A. 2012. Landscape context and scale differentially impact coffee leaf rust, coffee berry borer, and coffee root-knot nematodes. Ecol. Appl., 22, 584–596. https://doi.org/10.1890/11-0869.1

mobile app, which also enables traceability for compliance with the EU Regulation on Deforestation-free and child-labor-free supply chains.[34] As part of the 2023 G20 conference, CGIAR researchers also put forward a framework for collaboration between LMICs and high-income countries to develop and implement sustainability standards across borders.[35] Similarly, in October 2025, CGIAR and Germany's Federal Ministry for Economic Cooperation and Development (BMZ) cohosted a webinar to examine EU deforestation regulations and their implications for food production in LMICs.[36] These areas of work benefit EU consumers by ensuring food imports comply with sustainability standards in the EU.

Summary

In sum, the benefits to the EU of investment in CGIAR far outweigh the value of funding to CGIAR since 1971. EU and Member States annual funding to CGIAR has averaged about €184 million over recent years and this is far outweighed by the value of benefits to the EU outlined in this report.[37] Some of the benefits are quantifiable: an additional 3.5 million tonnes of wheat production in the EU each year from higher-yielding varieties, averted wheat stem rust losses, valued at €1.2 billion, an additional €23 billion in EU exports each year. Additional benefits include increased availability and affordability of healthy foods for EU consumers, better disease surveillance, improved environmental outcomes, and strengthened EU networks across the developing world. Together the benefits make CGIAR a good investment for the EC.

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[34] Calero, J., Minot, N., Wiegel, J., Reyes, B., Ceballos, F. and Colindres, M. 2024. Integrated coffee sales standard: IPSR Innovation Profile. First edition, June 2024. Montpellier: CGIAR System Organization. https://hdl.handle.net/10568/155329

[35] Halimatussadiah, A., Buchori, D., Carazo, F., Swinnen, J., Adriansyah, M., Ghiffari, M.N., et al. 2023. Advancing a global collaborative partnership framework for sustainability standards and regulations. T20 Policy Brief. https://t20ind.org/research/advancing-a-global-collaborative-partnership-framework/

[36] CGIAR Seminar Series. The EU Deforestation Regulation: Policy Implications and Research Frontiers. Scheduled for October 14, 2025. Co-organized by IFPRI, CGIAR, and BMZ. https://www.ifpri.org/event/the-eu-deforestation-regulation-policy-implications-and-research-frontiers/

[37] CGIAR. Accessed September 2025. CGIAR Trust Fund Contributions. https://www.cgiar.org/funders/trust-fund/trust-fund-contributions-dashboard/

Box 1: Methods used to estimate the impacts of CGIAR investments on the EU

1.1 Method used to estimate the impact of CGIAR technologies adopted in the EU on crop production in EU countries

Estimating the benefits of CGIAR-related technologies in a recipient country requires approximate impact estimates at each period of the typical generations of CGIAR-related technologies that were commonly used in the recipient country, with an assumption that later generations of technologies would have greater impacts on total factor productivity.[38] While these parameter estimates are generally only partially available for a specific crop, country, and period (including for wheat in the EU) it is possible to obtain reasonable estimates of these impact figures through the use of available secondary information.

We estimate the average generation of CGIAR-related wheat varieties in the EU using the information on the international flow of germplasm from other countries to the EU, the share of cultivated area where improved ("modern") varieties were planted, and the average generation of these modern varieties in the origin countries sharing germplasm with the EU. Specifically, we estimate the average generation of CGIAR-related varieties registered in the EU at each quinquennial period (1966-70, 1971-75, 1976-80, …) as a function of the weighted average of the generations of modern varieties in origin countries (countries that provide germplasm to EU genebanks and breeding programs, including those in the EU itself), the shares of modern varieties adopted in these origin countries, and the total number of germplasm accessions received by the EU from these origin countries. We estimate the average generation of CGIAR-related wheat varieties in the EU at each period (G_t) as

$$G_t = \sum_I G_{i,t-1} \cdot S_{i,t-1} \cdot N_{i,t-1}$$

where $G_{i,t-1}$ is the average generation of CGIAR-related wheat varieties in origin country i providing germplasm to the EU in period $t-1$. $G_{i,t-1} = 1$ if all CGIAR-related wheat varieties in country i in period $t-1$ are from first-generation modern varieties, $G_{i,t-1} = 2$ if all CGIAR-related wheat varieties in country i in period $t-1$ are from second-generation modern varieties, and $G_{i,t-1} = 1.5$ if first-generation and second-generation modern varieties account for an equal share among all CGIAR-related wheat varieties. Also, $G_t = 0$ if the EU received germplasm only from countries (including the EU itself) where no modern varieties were used in $t-1$. $S_{i,t-1}$ is the area share of modern wheat varieties to the total wheat area planted in the origin-country i providing germplasm to the EU in period $t-1$. $N_{i,t-1}$ is the proportion of accessions received by the EU from each origin-country i in $t-1$.

Information on $N_{i,t-1}$ is taken directly from the GENESYS database for all countries, including the EU, for each quinquennial period.[39] Information on $G_{i,t-1}$ and $S_{i,t-1}$ for developing countries is taken directly from the supplementary data for the recent study by Fuglie and Echeverria, while those for the EU and other high-income countries are estimated recursively.[40] For the EU and other high-income countries, $G_{i,t-1}$ is estimated recursively by setting the initial period value $G_{i,1961-65} = 1$ (when most available modern varieties were from first generation varieties) and estimating G_{it} in subsequent quinquennial periods.

[38]The incremental rate of productivity improvement associated with the switch from one generation to the next generation of modern varieties varies depending on the crop and the country or the agroecological environment. Nonetheless, reasonable figures are available for various cases in the literature. In the case of wheat varieties adopted in The EU and other high-income countries, the productivity effects of the switch to one generation newer varieties can be in the order of 10% (personal communication with Keith Fuglie, as well as *Fischer RA, D Byerlee & GO Edmeades. 2014. Crop yields and global food security: will yield increase continue to feed the world? ACIAR Monograph No. 158. Australian Centre for International Agricultural Research: Canberra. xxii + 634 pp.*

[39] GENESYS. 2025. GENESYS passport data. Available at https://www.genesys-pgr.org/. Accessed June 22, 2025.

[40] Fuglie K.O., Echeverria, R.G. 2024. The economic impact of CGIAR-related crop technologies on agricultural productivity in developing countries, 1961–2020. World Development, 176, 106523.

Key assumptions underlying this approach are that (i) the area shares of modern varieties in origin countries are the same as the share of modern varieties among all germplasm received by the EU in a particular quinquennial period, and (ii) the share of CGIAR-related varieties among the total pool of germplasm registered in the EU in each quinquennial period equals the share of wheat area in which CGIAR-related varieties are planted in the EU during that period. While direct evidence supporting these assumptions is relatively scarce, many studies on international germplasm exchanges and their roles in crop improvement in recipient countries provide indicative evidence that is consistent with these assumptions.[41, 42]

1.2 Additional note on CGIAR-related barley varieties in EU countries:

- **Adoption shares**: in the farmer benefit analysis, assumed 10 percent adoption of CGIAR barley varieties in EU countries for 2016-2020 period
    - In Germany (one of the largest barley producers in the EU), one of the five major spring barley varieties in the late 2000s had CG-related ancestries,[43] while one of the popular winter barley varieties in 2009 was also a CGIAR-related variety.[44, 45] Also, in Germany, a significant share of barley varieties registered since the 2000s originated from countries with high adoption rates of CGIAR varieties.[46, 47]
    - In the UK, between 1983 and 2004, at least 10 percent of certified barley seeds had CGIAR-originated varieties in their pedigrees.[48] At least 20 percent of new accessions registered in the UK since 1995 have had CGIAR-ancestors.[49,50]
    - Additional information from the literature and secondary data suggest that CGIAR-originated varieties have been used in barley plant breeding in EU countries (as well as in non-EU developed countries that often provide germplasms to EU countries).[51]
    - A back-of-the-envelope calculation based on the share of barley accessions received from each country and the prevalence of CGIAR-related varieties in

[41] Evenson, R., Gollin, D. 1997. Genetic Resources, International Organizations, and Improvement in Rice Varieties. Economic Development and Cultural Change 45(3): 471–500.

[42] Evenson, R., Gollin, D. 2003. Crop Variety Improvement and Its Effect on Productivity: The Impact of International Agricultural Research. Wallingford, UK: CABI.

[43] The variety *Scarlett* had a CG-related ancestor, *Georgie* (Friedt et al., 2011, Figure 8.1.1).

[44] *Zephyr* is one of the popular winter barley varieties in 2009, initially introduced in the Netherlands by CIMMYT in the 1970s (RAFI 1994 Table 3).

[45] Crop Research Institute. 2025. Barley Pedigee Catalogue. Available at https://www.vurv.cz/barley/pedigree/pedigree.php.

[46] Since 2000, accessions received from high-adopting countries, as identified by Fuglie & Echeverria (2024), namely Ethiopia, Ecuador, Egypt, Iraq, Jordan, Morocco, Syria, and Tunisia, have accounted for approximately 36% of all new accessions registered in the German gene bank, based on GENESYS data.

[47] Woolston, J. E. 1997. Wheat, barley, and triticale cultivars: A list of publications in which national scientists have noted the cooperation or germplasm they received from CIMMYT. CIMMYT Wheat Special Report No. 19. Third Edition. CIMMYT.

[48] For example, *Optic*, *Chariot*, *Atem*, *Hart*, *Golf*, *Riviera*, all with CGIAR-related ancestors, accounted for a total of 37% of certified seeds produced for Spring barley (which accounts for about half of total barley production in the UK in addition to Winter Barley) (Rae et al., 2007 Table 1).

[49] This is based on pedigree information where available in the GENESYS data and Barley Pedigree Catalogue (Crop Research Institute 2025).

[50] Friedt, W., Horsley, R.D., Harvey, B.L., Poulsen, D.M.E., Lance, R.C.M., Ceccarelli, S., Grando, S., Capettini, F. 2011. Barley breeding history, progress, objectives, and technology. In Barley: production, improvement, and uses, by SE Ullrich (eds.). New Jersey, USA. John Wiley & Sons.

[51] Many CIMMYT-developed barley varieties were provided to countries in Europe/America as early as the 1970s and the 1980, including *Berac*, *Julia*, *Mazurka* and *Zephyr* supplied to the Netherlands between 1965 and 1970, as well as *Clipper* and *WI 2197* (Australia), *Bonanza* (Canada) and *Beacon*, *CM 67*, *Klages*, *Manker*, *Nordic*, *Steptoe*, *Vanguard* and *Woodvale* (USA) (RAFI 1994, Table 3). Numerous other varieties from CIMMYT and ICARDA had been introduced into Canada, Poland, Portugal, and the US by the 1990s (Woolston 1997).

those countries suggests that, on average, 10 percent is a reasonably conservative assumption among the EU countries.[52]

- **Yield impacts**: in the farmer benefit analysis, assumed 10 percent increase in yields over base yield in 1981-85 for EU countries.[53]
    - In the UK, breeding progress in barley yield has been sustained at a rate of approximately 1 percent per annum,[54] similar to the rate assumed in the UK wheat study, where 10 percent was also assumed.
    - For Australia, where most barley is grown in regions with a similar climate to those in Southern Europe, ICARDA barley varieties can be expected to yield an increase of 20 percent from the 2002 level.[55]

1.3 Method used to estimate the impact of CGIAR investments on EU exports and prices

The impact of green revolution technologies on agricultural productivity growth as well as the impact of this growth on productivity in other sectors and incomes in developing countries has been carefully estimated in Gollin et al.[56] These estimates are used in this analysis to assess the impact of CGIAR investments on demand for exports from high income countries and on food prices globally.

The Gollin et al. study considers the impact of high-yielding crop varieties, not just CGIAR varieties.[57] Despite some evidence that the productivity impacts of the more fundamental research undertaken by the CGIAR are higher than those of more country-specific research undertaken at country level, for generating estimates of gains the total impact was apportioned by the share of total agricultural research and development funding that went to the CGIAR. This results in 9 percent of these gains being attributed to CGIAR research.

IFPRI's global economic model, MIRAGRODEP, was used to estimate the impact of increased income in low- and middle-income countries from CGIAR research on the demand for exports and imports in all countries, including the EU. The impact on prices is also estimated by this model. The advantage of using this model is its ability to assess the implications for trade between countries. MIRAGRODEP is a global Computable General Equilibrium (CGE) model based on MIRAGE.[58] The model was developed and improved with the support of the African Growth and Development Policy Modeling Consortium (AGRODEP). It is a multi-region, multi-sector, recursively dynamic CGE model. The model allows for a detailed

[52] For example, the calculated shares of CGIAR-related varieties among all newly registered varieties exceeded 20% in Germany and Romania, and 10% in Bulgaria and Sweden, while ranging around 5% for other EU countries (author's computation). In addition, the same approach yields an estimated share of 6% for Australia in the early 2000s, which is consistent with the figure suggested by Brennan et al. (2002), supporting the reasonableness of the estimation approach.

[53] Rural Advancement Foundation International (RAFI). 1994. Declaring the benefits: The North's annual profit from international agricultural research is in the range of U.S.$4-5 billion. It's time for an accounting. Occasional Paper Series, Vol. 1, No. 3. Computer Disk.

[54] Rae, S. J., Macaulay, M., Ramsay, L., Leigh, F., Matthews, D., O'Sullivan, D. M., ... & Thomas, W. T. B. 2007. Molecular barley breeding. Euphytica 158, 295-303.

[55] Brennan, J.P., Aw-Hassan, A., Quade, K.J. and Nordblom, T.L. 2002. Impact of ICARDA Research on Australian Agriculture, Economic Research Report No. 11, NSW Agriculture, Wagga Wagga.

[56] Gollin, D. Hansen, C. W. Wingender, A. M. 2021. Two blades of grass: The impact of the Green Revolution. Journal of Political Economy, 129(8), 2344-2384.

[57] Gollin, D. Hansen, C. W. Wingender, A. M. 2021. Two blades of grass: The impact of the Green Revolution. Journal of Political Economy, 129(8), 2344-2384.

[58] Decreux, Y. & Valin, H. (2007). MIRAGE, updated version of the model for trade policy analysis: Focus on agriculture and dynamics, Working Papers 2007-15, CEPII, Paris http://cepii.fr/PDF_PUB/wp/2007/wp2007-15.pdf

and consistent representation of the economic and trade relations between countries. A more detailed description of the model can be found in Laborde, Robichaud & Tokgoz, 2022.[59]

The impact of CGIAR technologies on EU exports were estimated for the EU using MIRAGRODEP. This effect was then allocated across EU countries as shown in Table 2 based on each country's share of total exports.

Box 2: Contributions of CGIAR to germplasms of various crops registered in gene-banks in each EU countries for which data are available

Crops	Countries	Number of accessions from CGIAR	Share (%) among accessions for which donor information is available
Barley	Bulgaria	112	4%
	Germany	479	2%
	Hungary	1716	47%
	Italy	24	38%
	Romania	223	11%
	Slovakia	17	2%
Wheat	Austria	9	1%
	Bulgaria	180	2%
	Czech	174	2%
	Germany	149	1%
	Hungary	1941	28%
	Italy	195	2%
	Poland	276	2%
	Slovakia	51	1%
	Spain	7	0%
Legumes (including common beans, peas, groundnuts, and other legumes)	Belgium	577	33%
	Bulgaria	818	60%
	Czech	9	14%
	Germany	247	3%
	Hungary	1837	49%
	Italy	633	42%
	Poland	11	2%
	Slovakia	112	8%
	Spain	232	11%
Forage	Austria	1	3%
	Bulgaria	51	31%
	Czech	15	2%
	Italy	370	15%
Other grains (including triticale, maize, rice, sorghum)	Bulgaria	376	40%
	Czech	111	19%
	Germany	16	6%
	Hungary	14	1%

[59] Bouët, A., Laborde, D., Robichaud, V., Traoré, F. and Tokgoz, S. (2022), MIRAGRODEP 2.0: Documentation, AGRODEP Technical Note 0026, IFPRI, Washington DC.

	Poland	4	0%
	Slovakia	52	6%
Other crops: Banana/Plantain	Belgium	164	10%
Total	**All 11 EU countries with records**	**11203**	**8%**

Source: Authors' compilations from the GENESYS data.

The information in this figure only considers germplasms for which any CGIAR centers are explicitly mentioned under the "Donor" category of the data. These figures are highly conservative estimates of the overall CGIAR contributions to the German agriculture, because they do not represent indirect inflows of CGIAR-derived germplasms to Germany, including varieties that contain CGIAR-developed varieties as ancestors but are shared with Germany by the third countries rather than directly through CGIAR. Figures are as of September 2025. Since GENESYS-data continue to get updated, the figures may slightly change over time. For other EU countries, GENESYS-data either provide no donor information of accessions, or do not include any accession data at all.

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