Agricultural R&D



AGRICULTURAL R&D

HALFTIME
FOR THE SUSTAINABLE DEVELOPMENT GOALS



BEST INVESTMENTS FOR THE SDGs

EXCELLENT BENEFIT COST RATIO: 33

Investment

Basic research and development, including capacity building, and technical and policy support with special focus on Low- and Lower Middle-Income countries. Research outcomes are difficult to predict, but an example could be crop yield increases using precision genetic technologies.

Authors

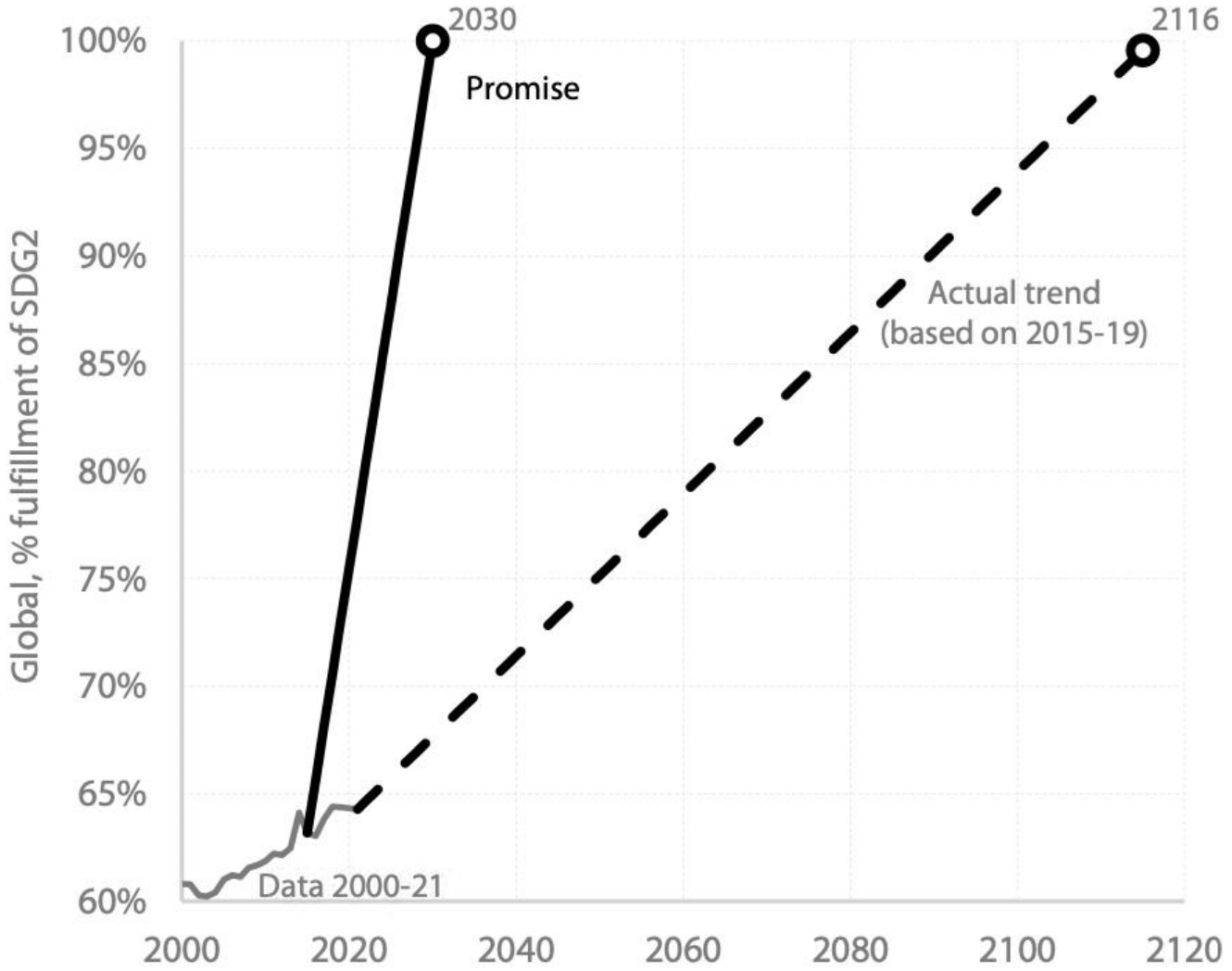
Mark W. Rosegrant, International Food Policy Research Institute, IFPRI
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Hunger

- One of the basic issues of humanity
- Fixed, if you're not poor
  - **GDP per person above $10,000 then nobody goes hungry**

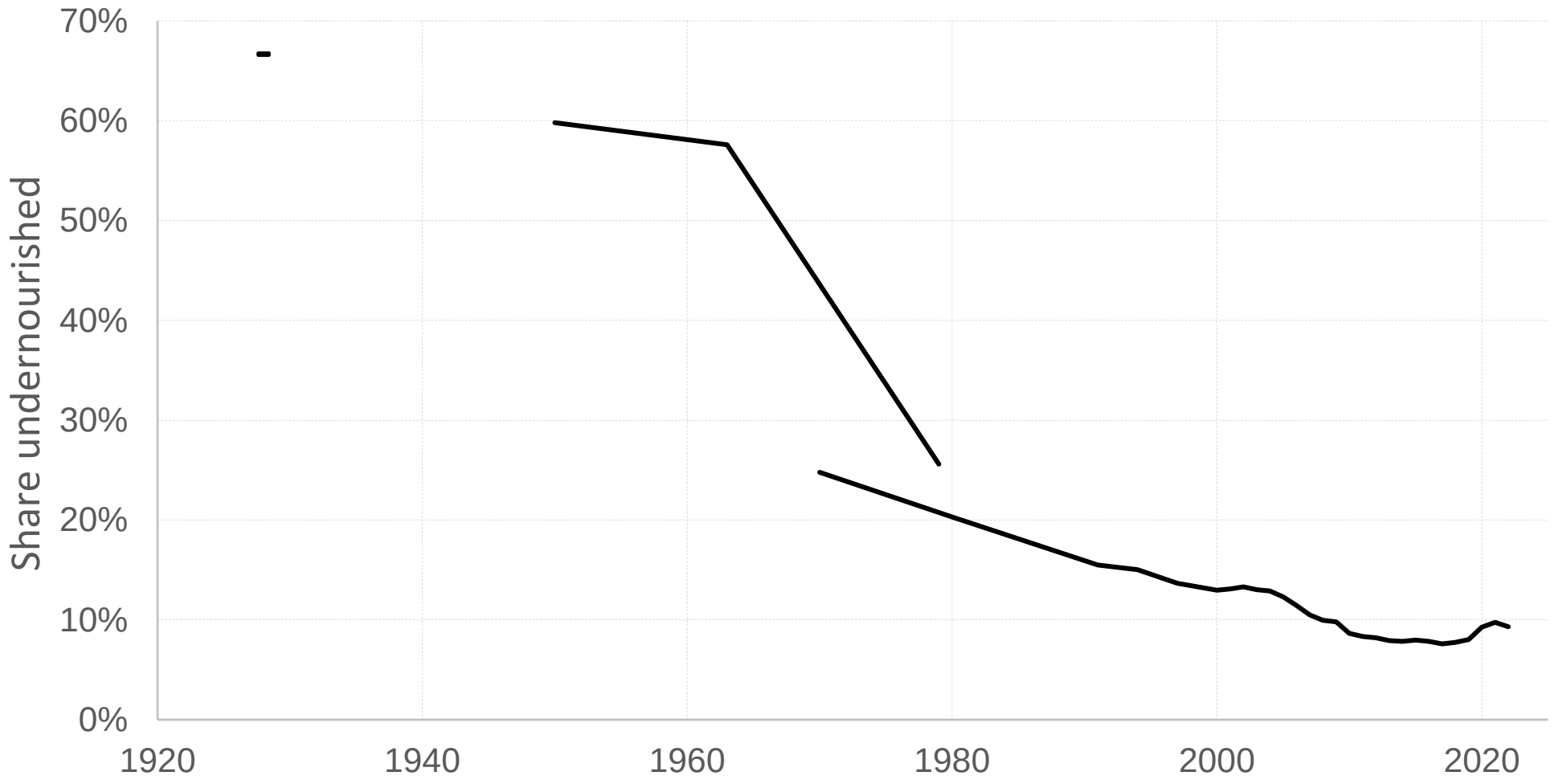
Global Fulfillment of SDG 2 - Zero Hunger



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Global hunger, 1928-2022



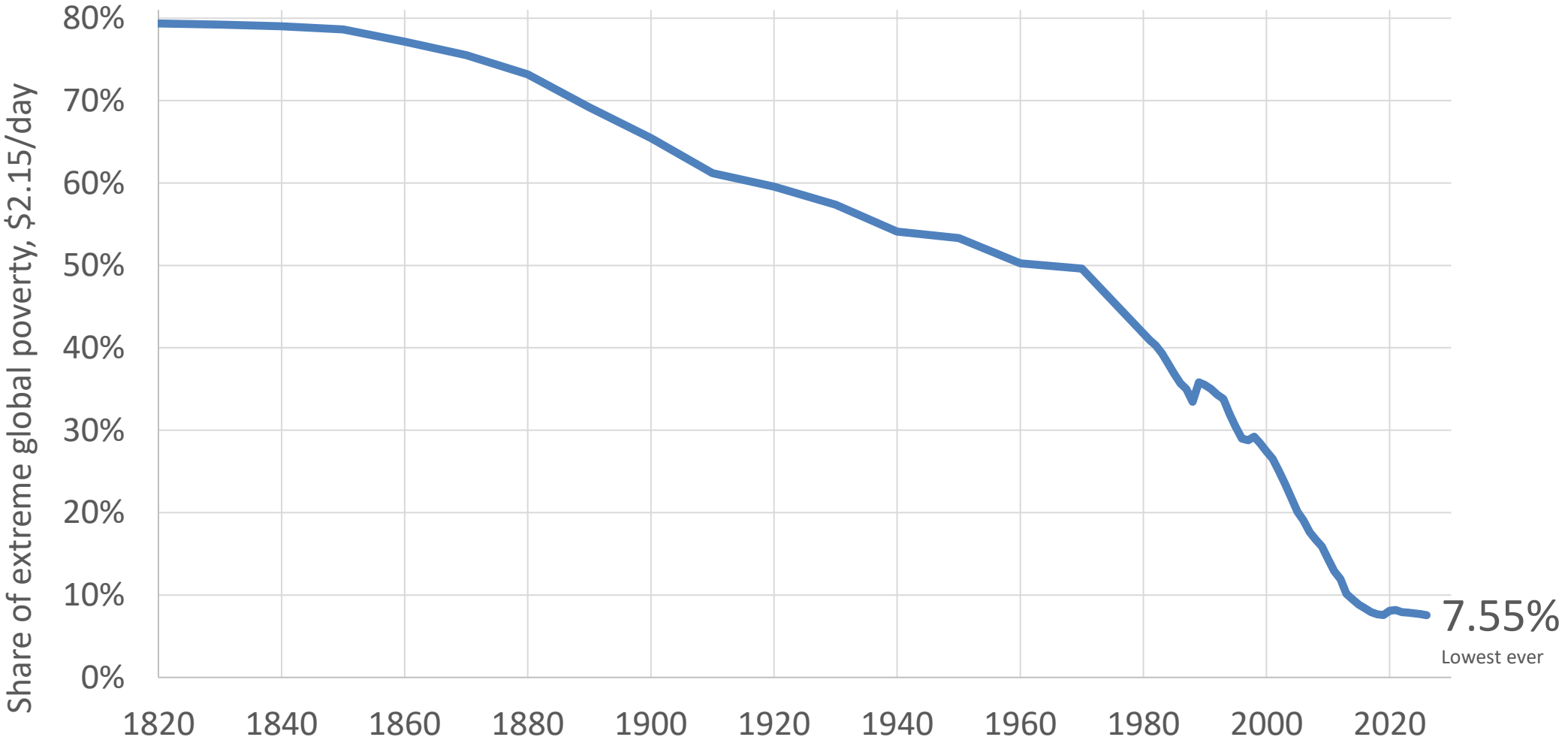
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Why has hunger decreased?

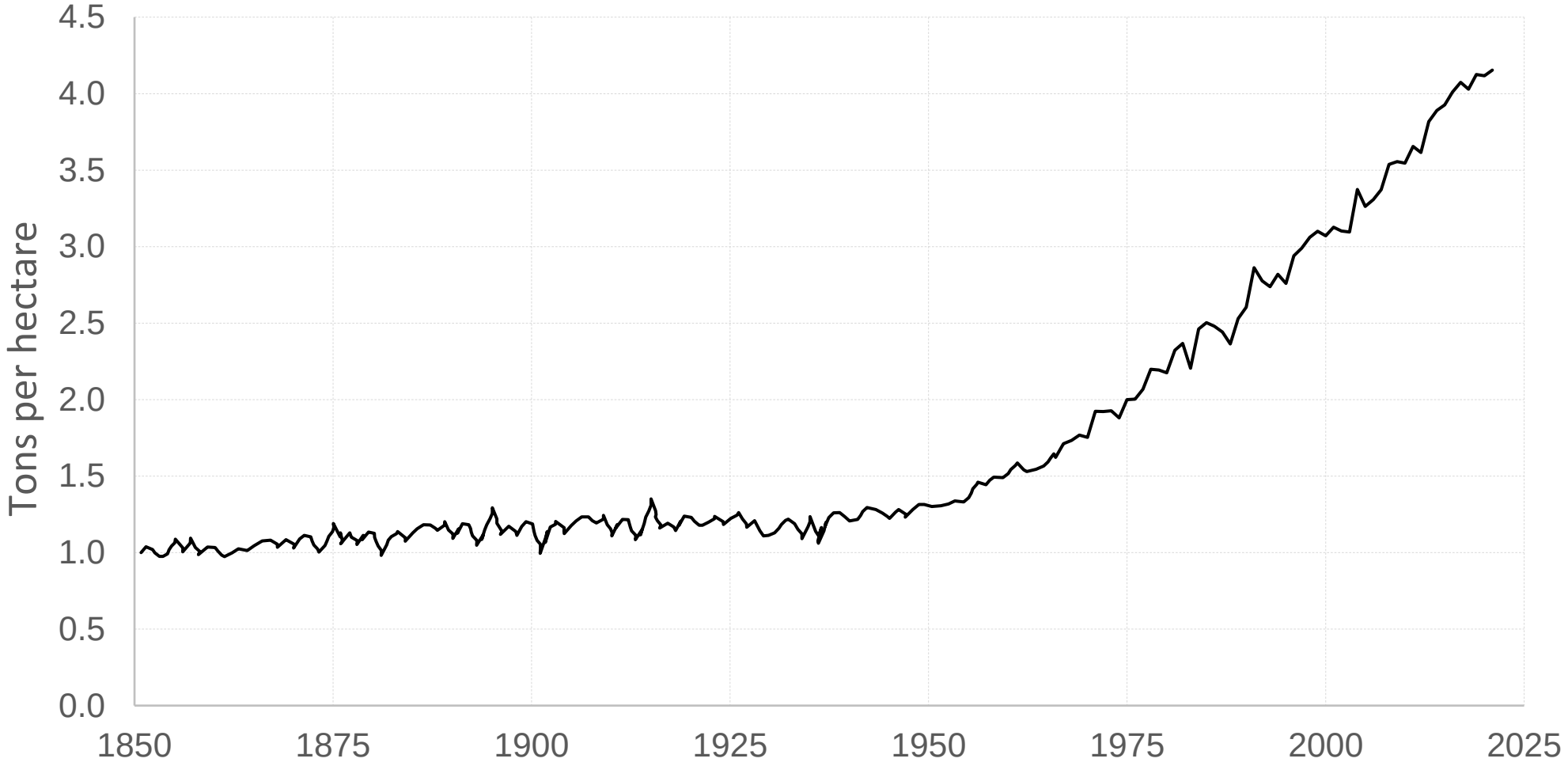
- Fewer poor
- Higher productivity

We are a lot less poor, 1820-2026



OECD 2021, World Bank 2026

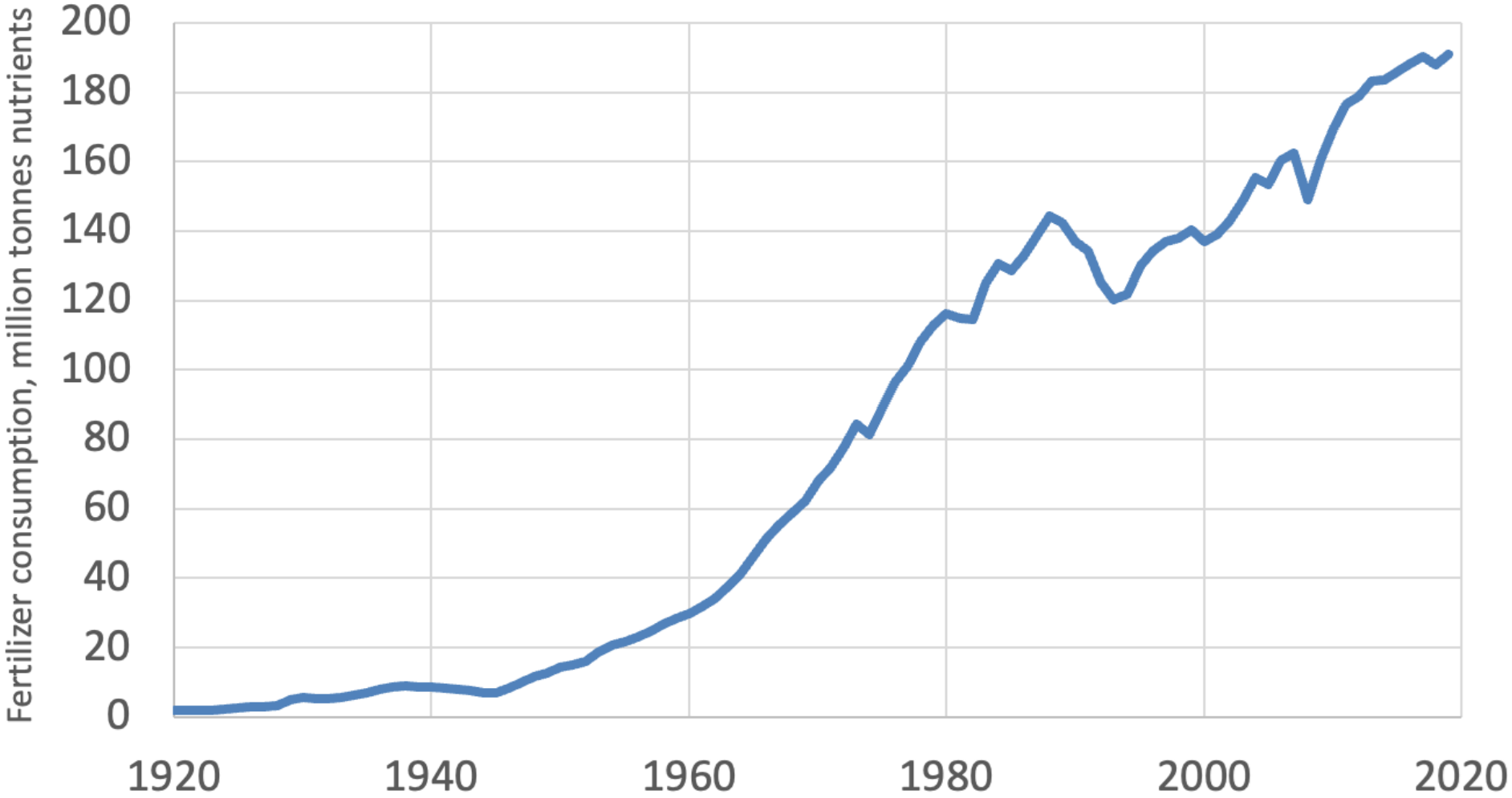
Global cereal yields 1850–2021



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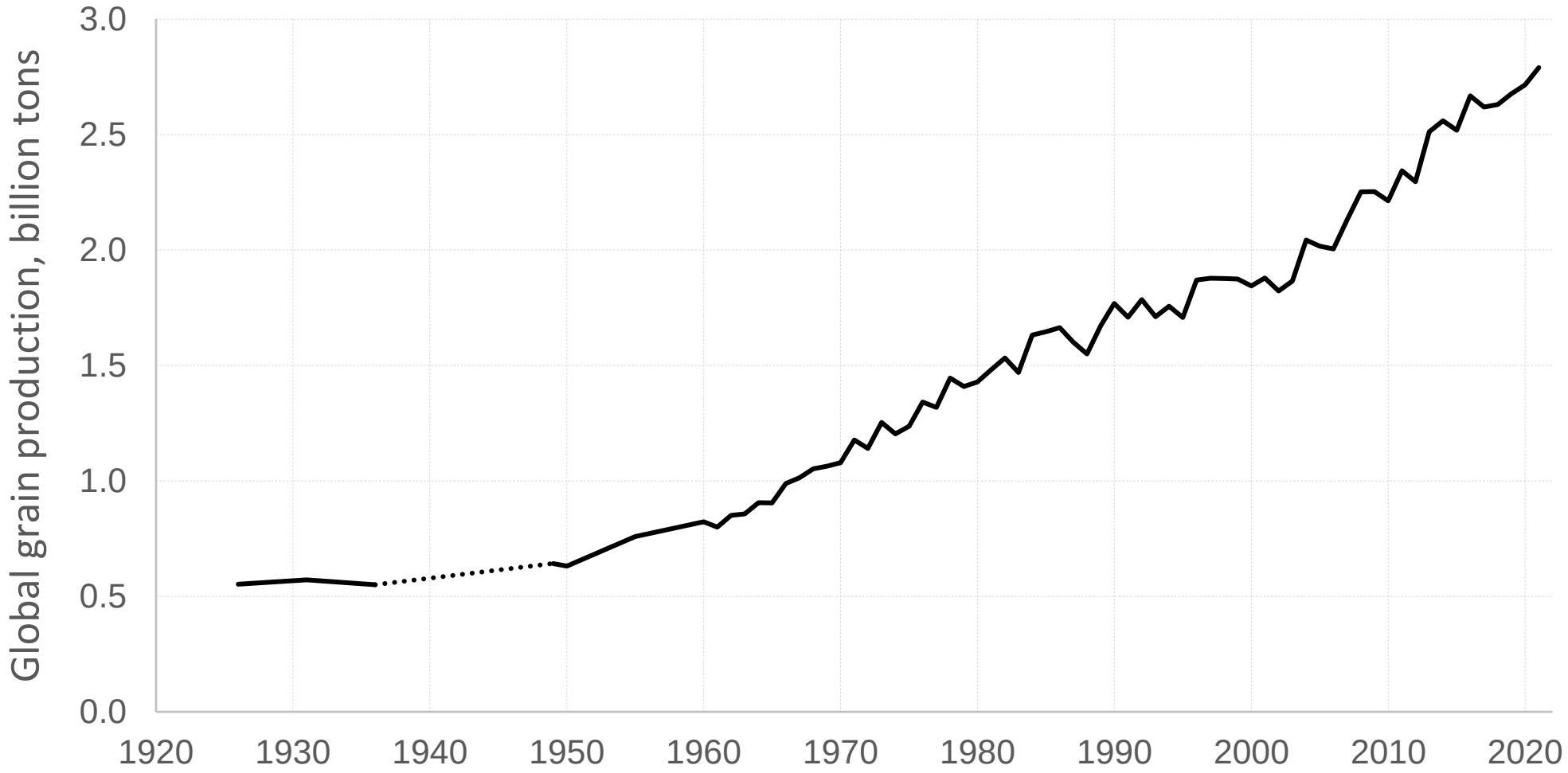
Global fertilizer consumption, 1920-2019



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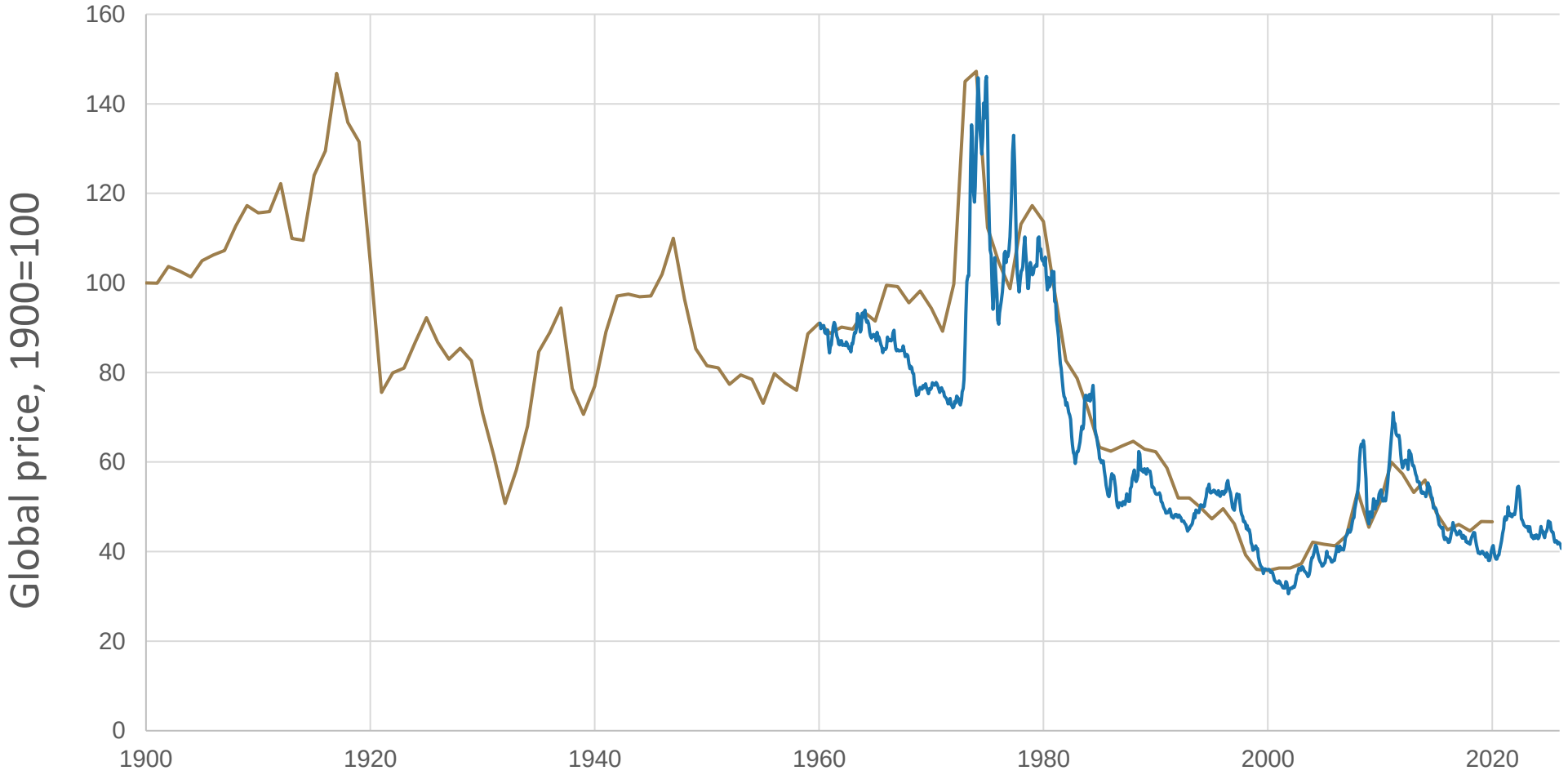
Global grain production 1926–2021.



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Food price halved, 1900-2026



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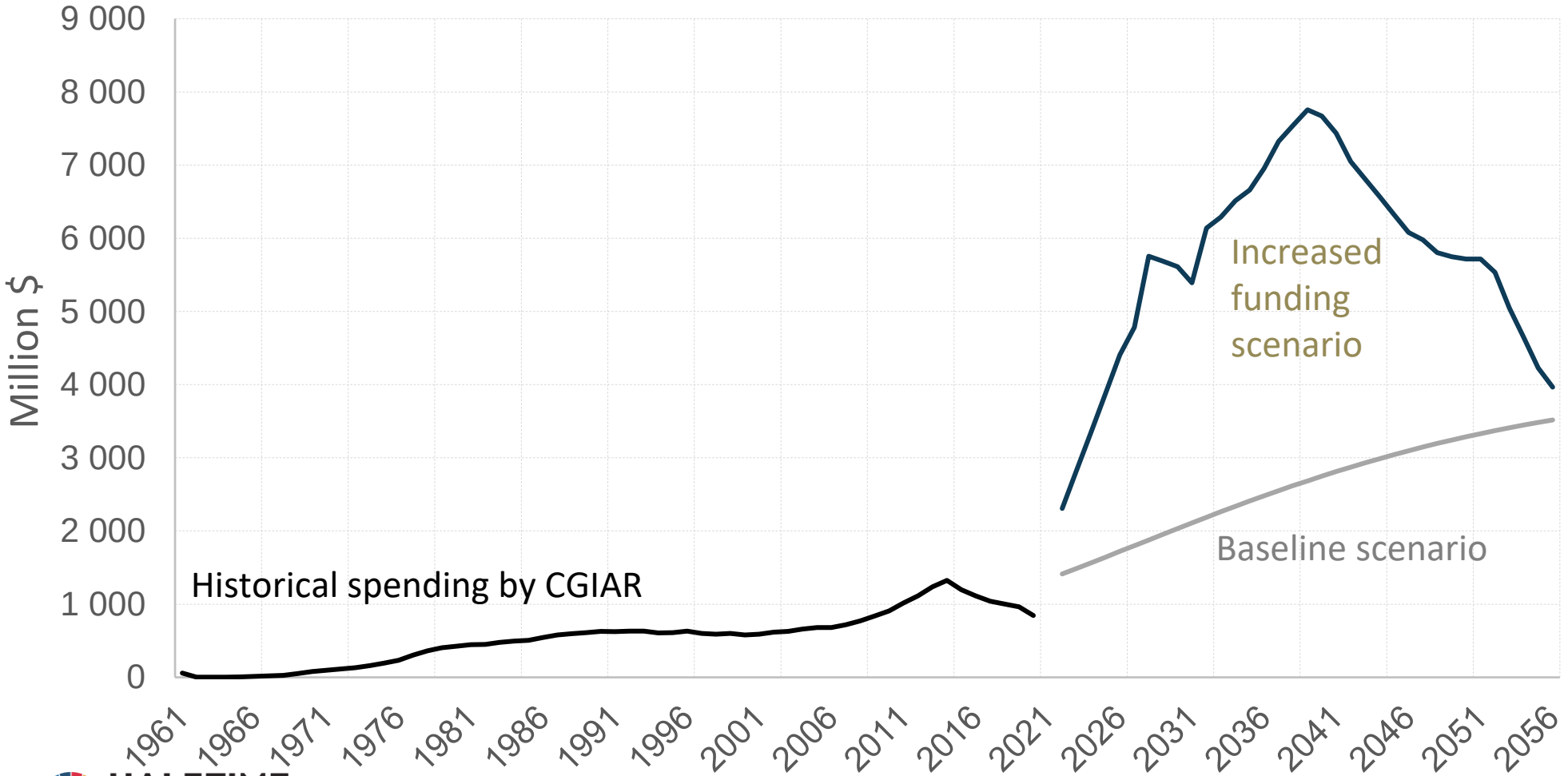
From 1900-2000

- 6-fold increase in agricultural production
- Less than 4-fold increase in global population
  - **50% more food**
- Food price halved
- We have become much more efficient
  - **The 1st Green Revolution**
    - Norman Borlaug

Policies

- What isn't great
  - **Free fertilizer, state-owned machinery, extension services storage and distribution, crop insurance**
    - We've done 45+ cost-benefit analyses
      - Insurance, less than $2 back in Haiti
      - Fertilizer and energy insurance, about $3 in Haiti
      - Extension services, $3.50 in Bangladesh
      - Farm loan waivers, can cost 0.5% of GDP in India, UP, Maharashtra, Punjab, <$1
- What does work
  - **R&D**

Funding for CGIAR, 1961–2056.



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Improve the system of agricultural services based on science and innovation

- A recent meta-analysis of more than 600 BCRs demonstrates that the average return is around 25:1 (Alston et al., 2022).
- The logic behind this finding is that relatively small investments upstream can lead to substantial improvements in the efficiency and yield of the entire agricultural sector.

R&D for agricultural yield increase

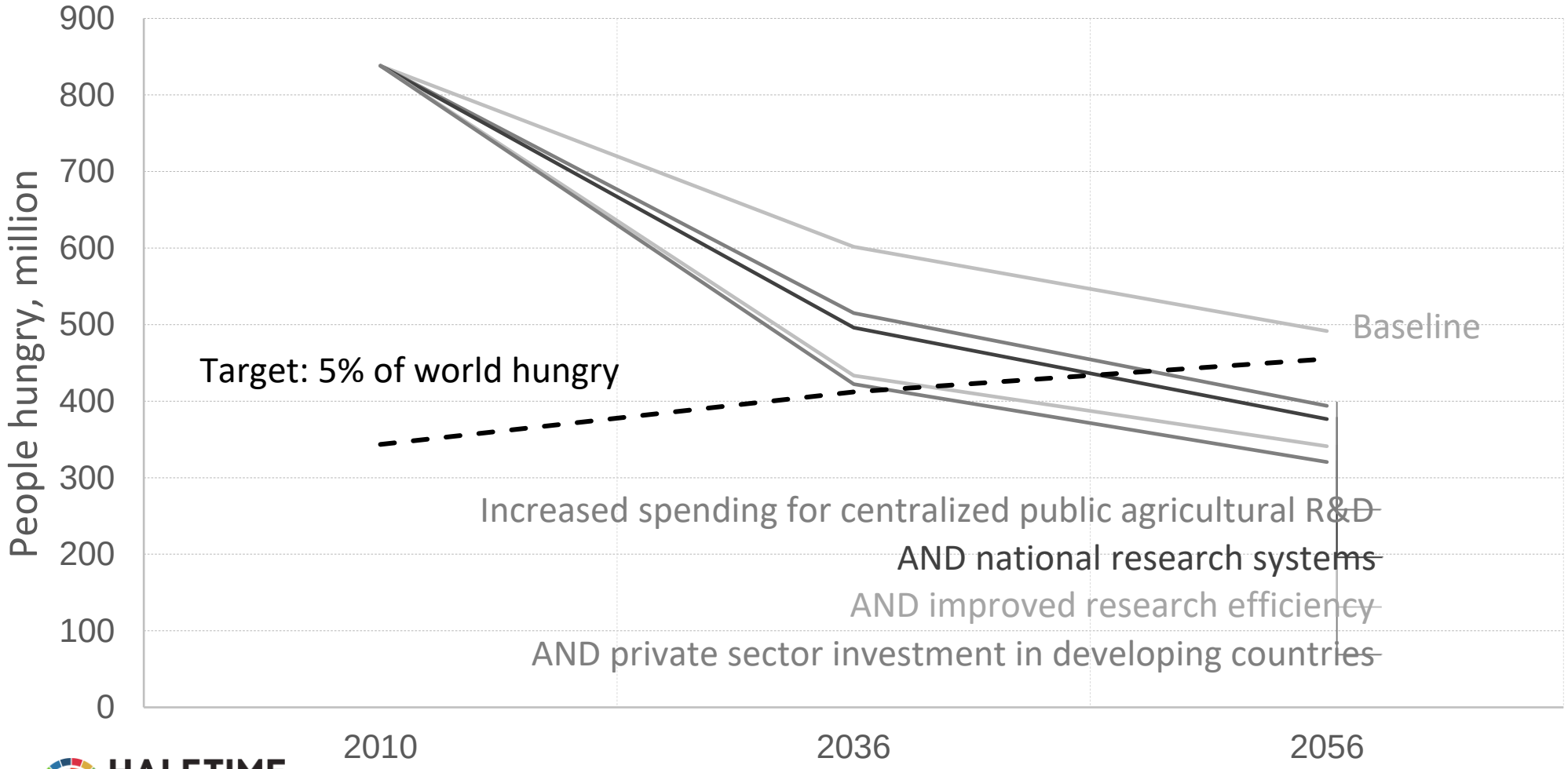
- Increased agricultural R&D affects hunger by boosting crop and livestock yields, reducing food prices, and increasing farm income and economy-wide GDP through multiplier effects on the non-agricultural sectors.
- Agricultural R&D at regional level via CGIAR has been proven to be consistently beneficial, particularly in sub-Saharan Africa, with average BCRs of 30.

R&D for agricultural yield increase

After 35 years, the increased funding is estimated to

- **Increase agricultural output by 10%**
- **Reduce the prevalence of hunger by 35%**
- **Reduce food prices by 16%**
- **Increase per capita incomes by 4%**

It can avoid 130M hungry



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Benefits and costs

	Benefits	Costs	BCR
Increased spending for centralized public agricultural R&D	$1,004	$35	29
AND national research systems	$1,294	$52	25
AND improved research efficiency	$2,178	$62	35
AND private sector investment in developing countries	$2,450	$74	33

Note: Costs and benefits are discounted at 8% per year.

CGIAR and IFPRI

Global Partial-Equilibrium Simulation Model

- International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT)
- Simulate how increased agricultural R&D affects:
  - **Crop yields**
  - **Production and consumption**
  - **Food prices**
  - **Hunger prevalence**
  - **Farm incomes**
  - **Trade flows**
- The model operates in constant USD

How IMPACT it works

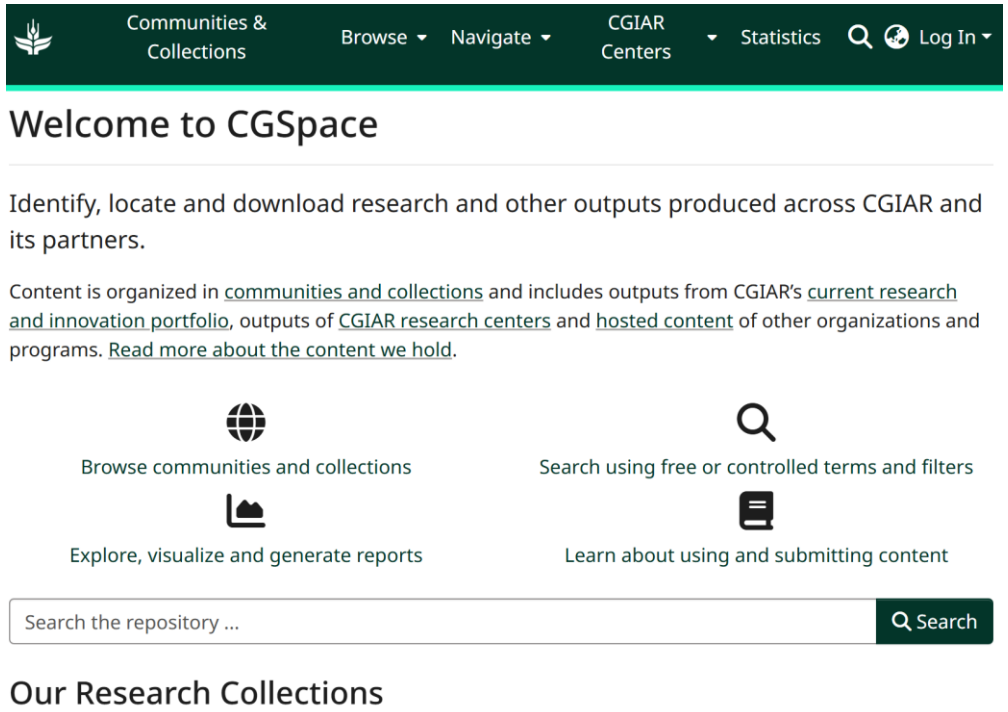
- IMPACT links biophysical crop models, global commodity markets, and country-level demand systems
- R&D enters the model as productivity shocks (yield growth accelerations) applied to specific crops and regions
- The model then propagates these shocks through supply, demand, and price systems

Evidence base

- Historical R&D Productivity Elasticities
  - **Decades of empirical literature show high returns to agricultural R&D**
  - **These elasticities calibrate how R&D spending translates into yield growth**
- Biophysical Crop Models
  - **Used to estimate how genetic improvements translate into yield gains under climate and soil constraints**
- Global Commodity Market Data
  - **FAO, USDA, IFPRI datasets for prices, production, consumption, and trade**
- Demographic and Income Projections
  - **Estimate future food demand and hunger prevalence**

Vast amount of research (papers, books, reports) for achieving more and cheaper food

- Complete outputs of CGIAR research centers — AfricaRice, the Alliance of Bioversity International and CIAT, the International Food Policy Research Institute, the International Institute of Tropical Agriculture, the International Livestock Research Institute, the International Potato Center, and the International Water Management Institute. The International Crops Research Institute for the Semi-Arid Tropics and the International Rice Research Institute are currently migrating their repositories into CGSpace.
- Selected outputs from other centers — the International Center for Agricultural Research in the Dry Areas, the International Maize and Wheat Improvement Center and WorldFish, as well as the Center for International Forestry Research (and ICRAF)



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AI exercise: CGIAR database

Use CGIAR research for policy and CBA input

AI exercise:
Audit the evidence in IHME, DCP3, and DCP4

- Participants ask AI to:
  - **Identify and review up to 5 relevant reforms**
  - **Only use CGIAR publication database**
  - **Look for credible evidence for use in CBA**
  - **Prioritize country or regional evidence, explain transferability limits**



14:45–15:05 **Big models and best policies for agriculture**
Global Partial-Equilibrium Model for more and cheaper food

15:05–15:15 **AI exercise: high-return agricultural reforms**
Use CGSpace research for evidence relevant to your country

Copy CGSpace prompt

Show CGSpace prompt

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