Gene Editing for the Climate: Biological Solutions for Curbing Greenhouse Emissions

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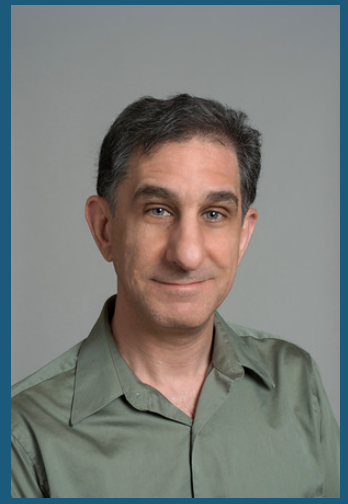
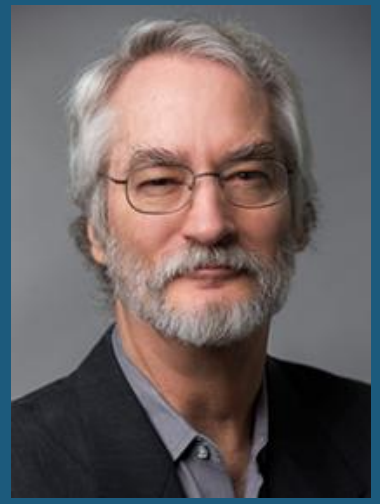


David

Rob



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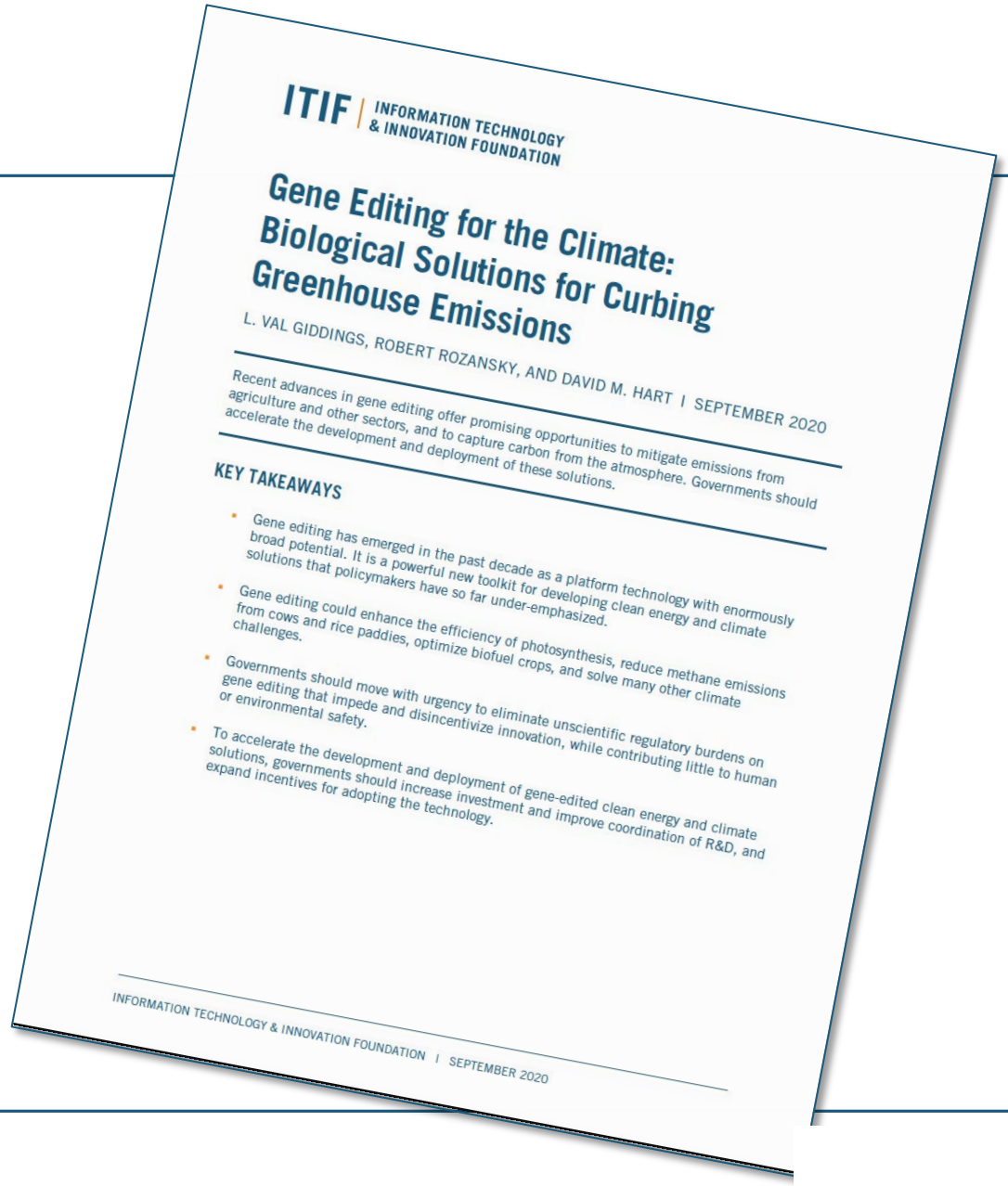
  - Innovation and competitiveness
  - IT and data
  - Telecommunications
  - Trade and globalization
  - Life sciences, agricultural biotech, and energy
- Formulates and promotes policy solutions that accelerate innovation and boost productivity to spur growth, opportunity, and progress
- World's top think tank for science and technology policy, according to the University of Pennsylvania's authoritative *Global Go To Think Tank* Index



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Gene Editing for the Climate: Biological Solutions for Curbing Greenhouse Emissions

L. VAL GIDDINGS, ROBERT ROZANSKY, AND DAVID M. HART I SEPTEMBER 2020

Recent advances in gene editing offer promising opportunities to mitigate emissions from agriculture and other sectors, and to capture carbon from the atmosphere. Governments should accelerate the development and deployment of these solutions.

KEY TAKEAWAYS

- Gene editing has emerged in the past decade as a platform technology with enormously broad potential. It is a powerful new toolkit for developing clean energy and climate solutions that policymakers have so far under-emphasized.
- Gene editing could enhance the efficiency of photosynthesis, reduce methane emissions from cows and rice paddies, optimize biofuel crops, and solve many other climate challenges.
- Governments should move with urgency to eliminate unscientific regulatory burdens on gene editing that impede and disincentivize innovation, while contributing little to human or environmental safety.
- To accelerate the development and deployment of gene-edited clean energy and climate solutions, governments should increase investment and improve coordination of R&D, and expand incentives for adopting the technology.

Contents

Motivation: Biology's Role in Climate Change

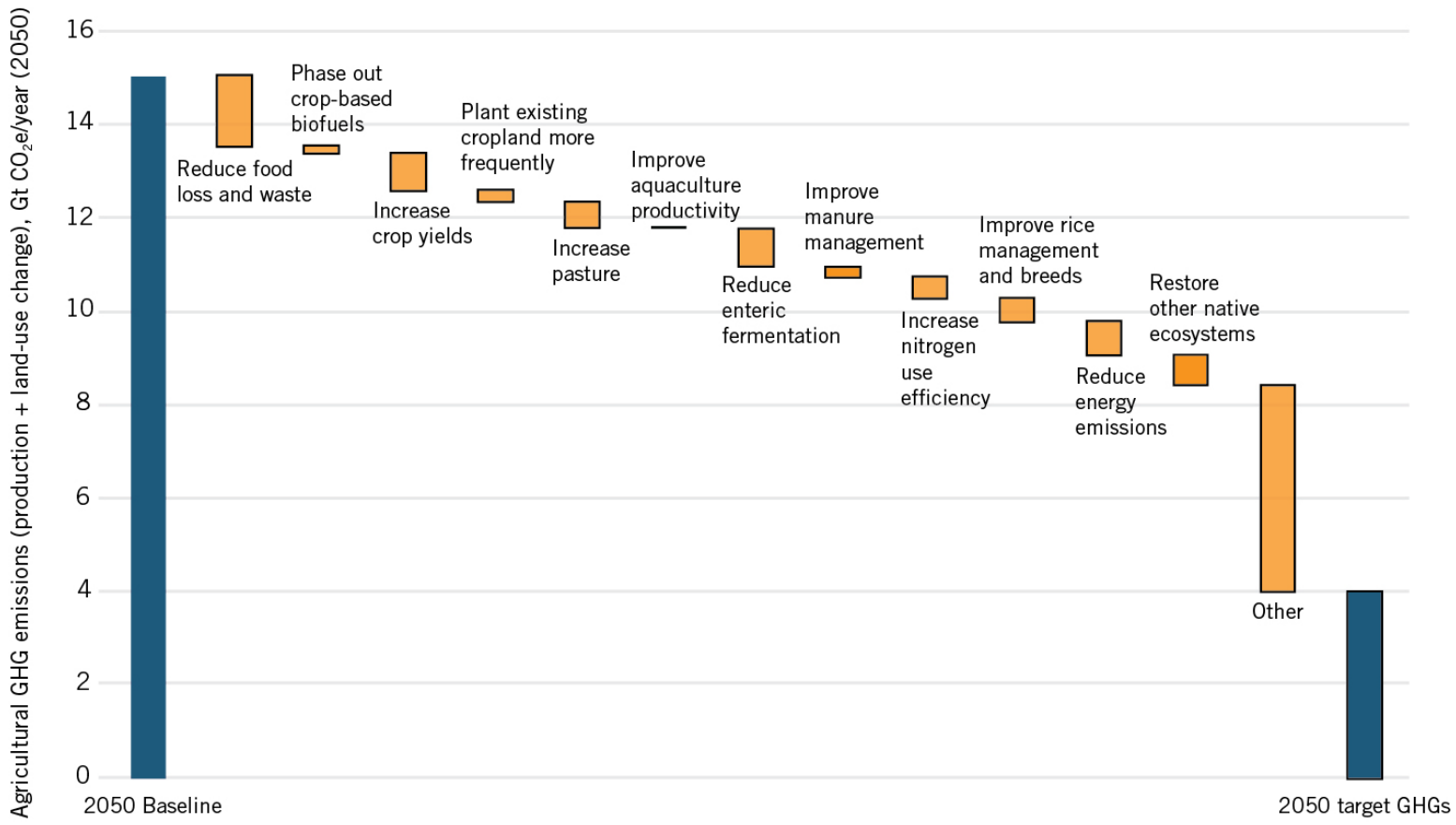
- Greenhouse gases from living (or deceased) organisms are a major component of current GHG emissions
- Plants and microbes have great potential to reduce emissions
- Biological CO2 fixation can significantly expand existing carbon sinks
- Biological mechanisms for improving production efficiency (reducing emissions) and increasing Carbon capture can be improved and magnified through gene editing

Contents

Gene Editing: New Tools for GHG Mitigation and Capture

- Gene editing is the most recent stage in the development of techniques to improve plants, animals, and microbes for human uses
- It builds on earlier stages, from domestication through selective breeding, hybridization, to genetic engineering (recombinant DNA/transgenics)
- CRISPR-mediated gene editing is derived from defense mechanisms bacteria evolved to defend against predatory viruses
- Gene editing is more precise, predictable, and thus safer than older methods of genetic improvement (which were *very safe*)
- It can be used to improve plants, animals, and microbes in myriad different ways

Gene Editing: New Tools for GHG Mitigation and Capture



Contents

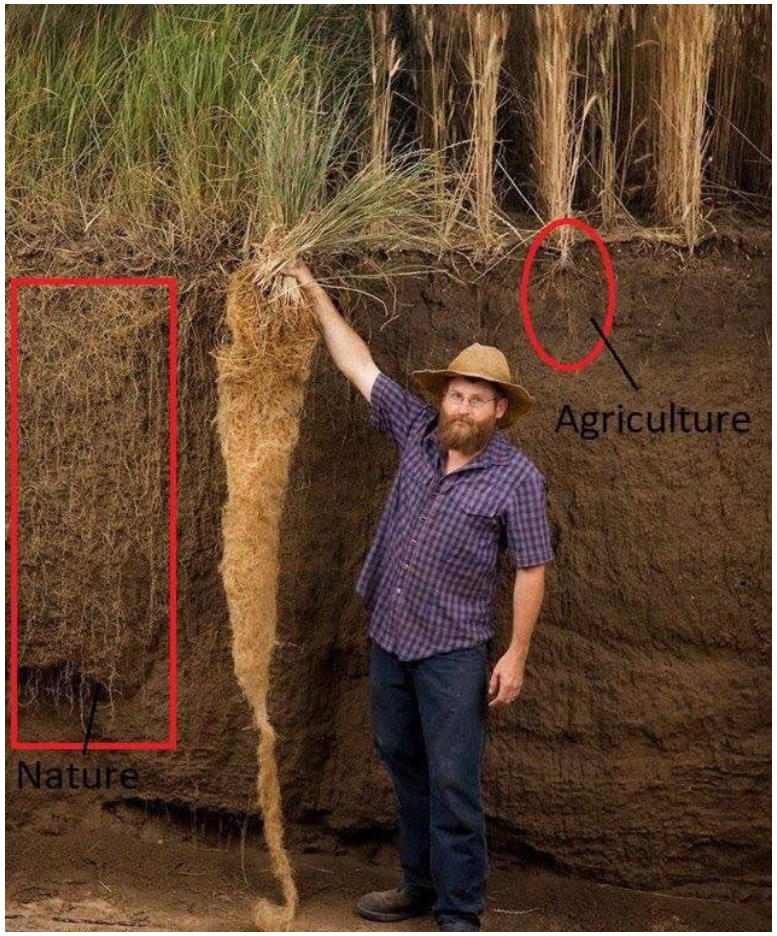
Enhancing Photosynthesis to Cut Emissions & Increase CCUS

Agriculture: Minimizing Food Loss and Waste

Agriculture: Reducing Bovine Emissions

Transportation: Improving Biofuel Production

Negative Emissions: Enhancing Photosynthesis



Contents

Policy Priorities for the U.S. & International Community

1 Regulatory Reform

- Unscientific regulations are barrier to innovation
- Agricultural biotech has record of safety (vetted by 11 National Academies studies)
- Potential Action: U.S. agencies implement Executive Order 13874 on streamlining ag biotech regulatory framework

Policy Priorities for the U.S. & International Community

1 Regulatory Reform

2 Increased R&D Investment

- Investment in gene editing should increase severalfold
- R&D priorities include CRISPR fundamentals, soil carbon measurement methods, photosynthesis, and more
- Potential Action: Congress establishes ag-focused Advanced Research Projects Agency (e.g., ARPA-Terra)

Policy Priorities for the U.S. & International Community

1 Regulatory Reform

2 Increased R&D Investment

3 Improved Coordination of R&D Priorities

- Domestic and international coordination can accelerate progress
- Potential Action: Nations leverage existing international efforts for multilateral coordination (e.g., Bill and Melinda Gates Foundation's RIPE project)

Policy Priorities for the U.S. & International Community

1 Regulatory Reform

2 Increased R&D Investment

3 Improved Coordination of R&D Priorities

4 Incentives to Deploy Gene-Edited Technologies

- Incentives facilitate broader adoption and cost reductions
- Potential Action: Governments expand conservation programs to incorporate gene-edited products for carbon sequestration

Thank You!

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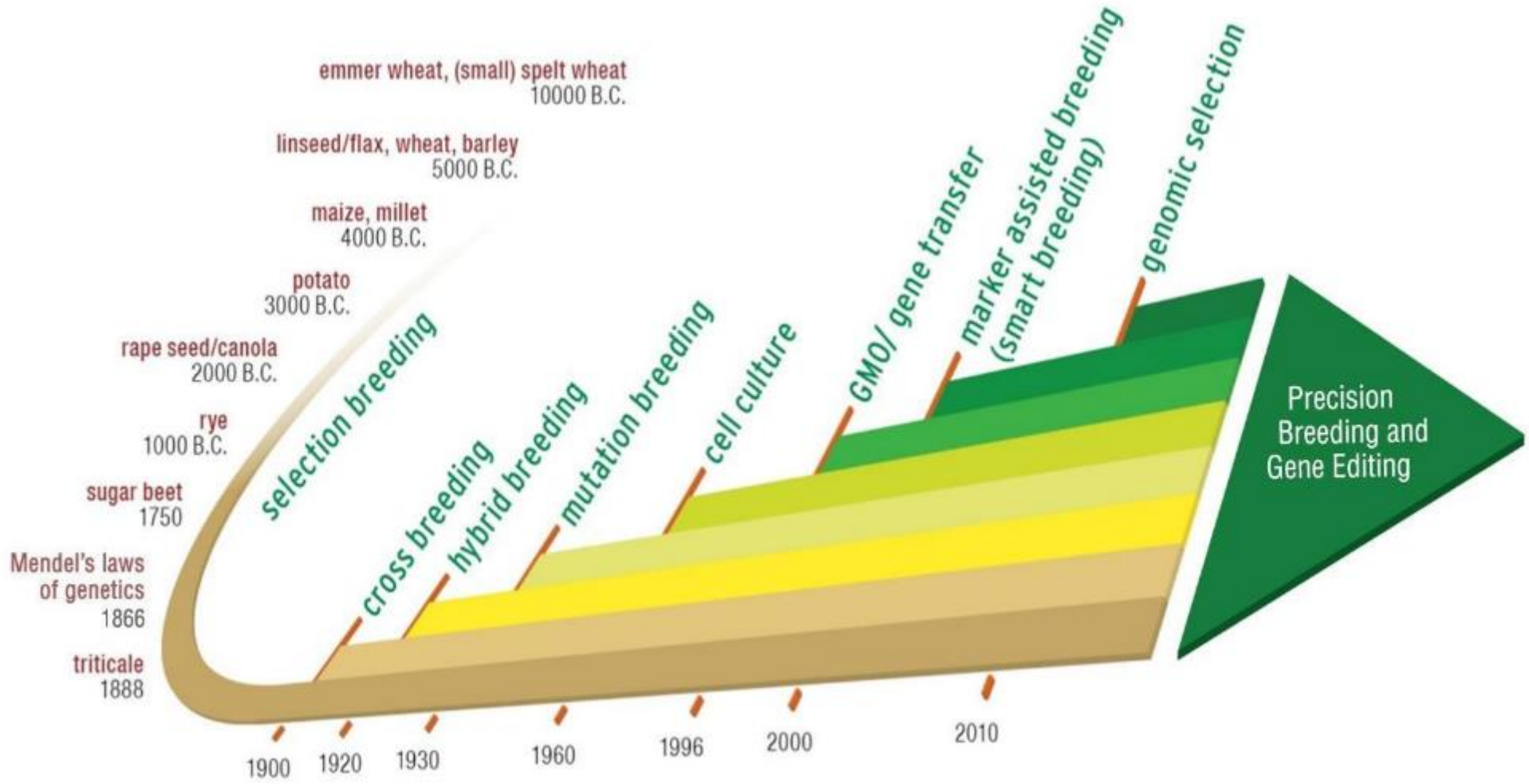
Science and technology are essential to crop improvement



Living up to Our Responsibility

Achieving our transformational commitments by 2030 & delivering tailored crop solutions to our customers

Advancing a carbon-zero future for agriculture

30% Reduction in field greenhouse gases emitted per kg of crops produced

Produce higher-yielding crops with fewer natural resources and inputs

30% Reduction in Crop Protection impact on the environment

Empowering smallholder farmers to access sustainable agricultural solutions

>100M Smallholders benefit from access to education, products & partnerships

Short Stature Corn offers a

Transformational Shift in Production

by giving growers better control over their land during the growing season.