



✓ Energy Sprawl Expansion of
land footprint used for energy production

✓ Carbon Debt

Refers to the amount of CO₂
released as native habitats are converted
to cropland

US Climate Action Partnership



JOHN DEERE



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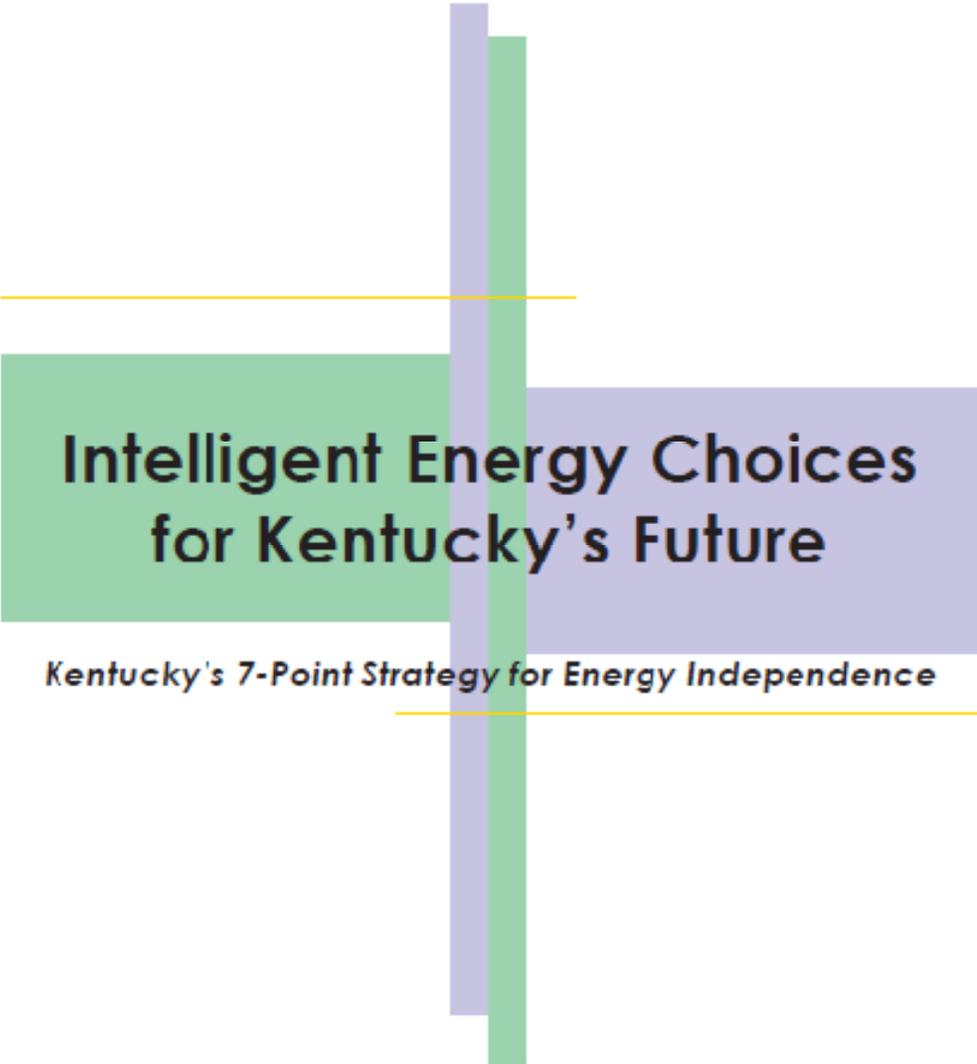
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Intelligent Energy Choices for Kentucky's Future

Kentucky's 7-Point Strategy for Energy Independence



GOVERNOR STEVEN L. BESHEAR

November 2008

Kentucky's 21st Century Challenge

- * Meet Kentucky's needs for 40% more energy by 2025
- * Develop clean, reliable, affordable energy sources
- * Improve our energy security
- * Diversify our energy portfolio
- * Reduce carbon dioxide emissions
- * Provide economic prosperity

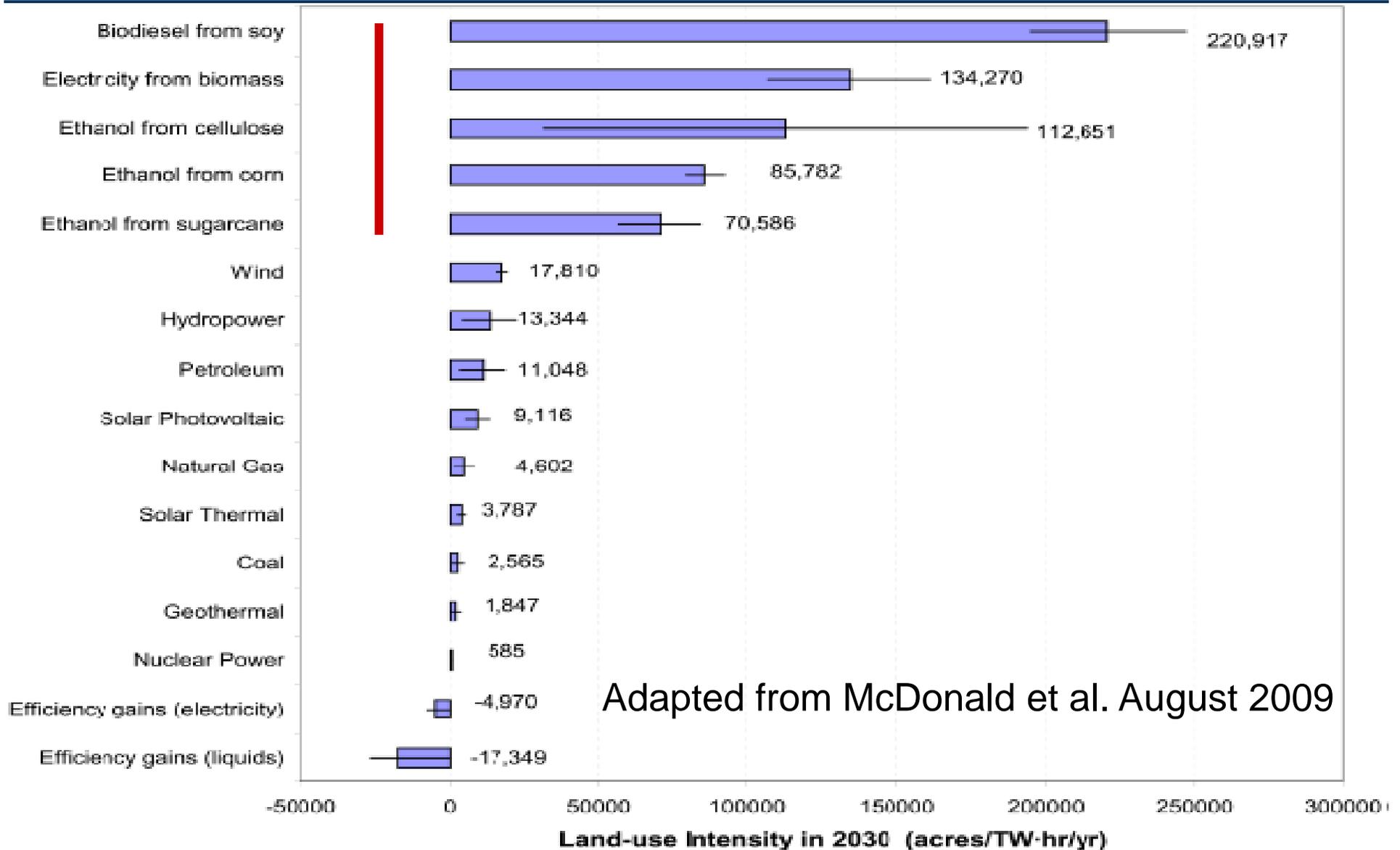
Ethanol Can Contribute to Energy and Environmental Goals

Alexander E. Farrell,^{1*} Richard J. Plevin,¹ Brian T. Turner,^{1,2} Andrew D. Jones,¹ Michael O'Hare,² Daniel M. Kammen^{1,2,3}

“Our best point estimate for average performance today is that corn ethanol ... reduces GHG emissions by 13%.”

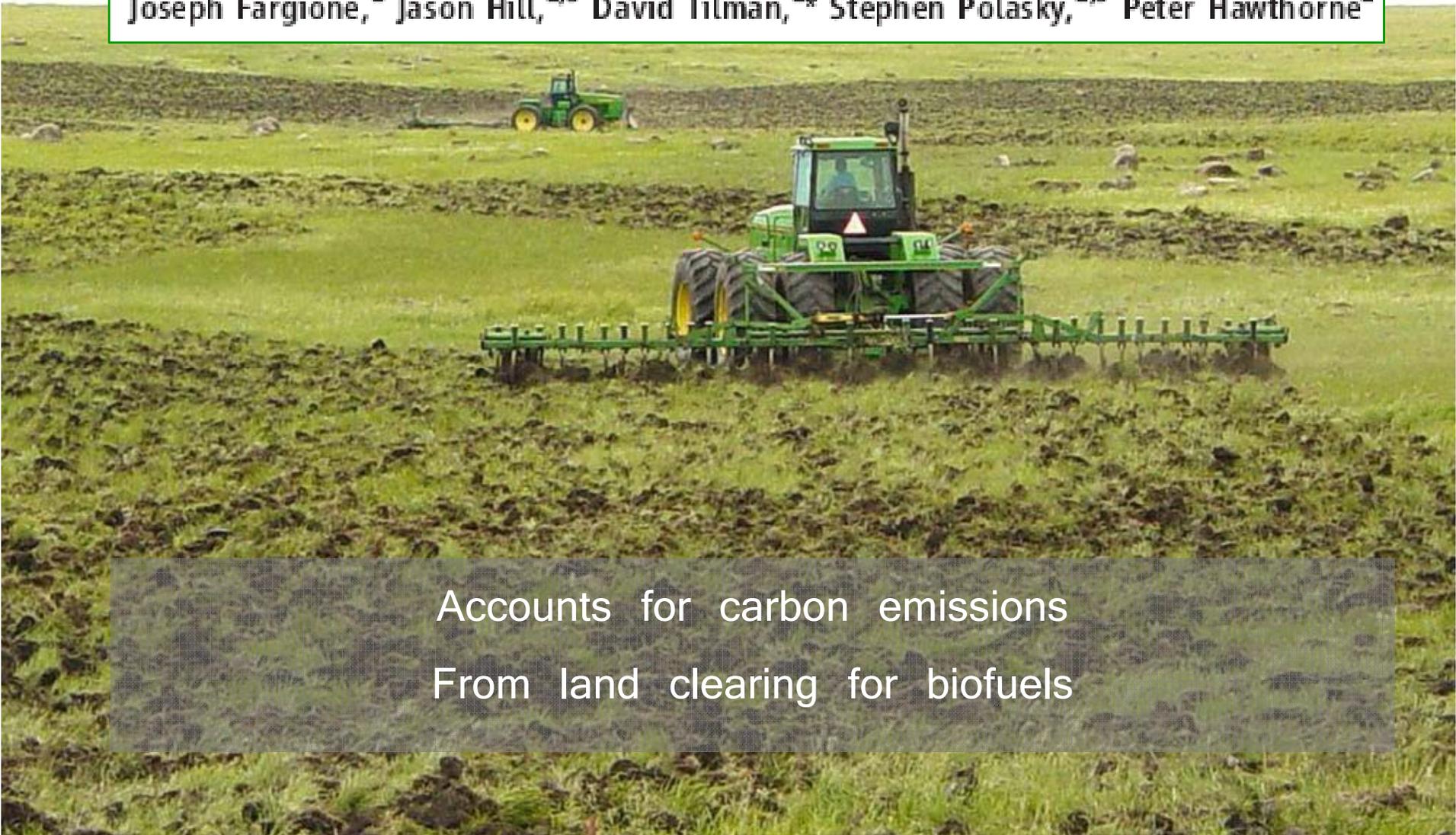
“we ignore GHG emissions due to potential changes in land use.”

Energy Sprawl



Land Clearing and the Biofuel Carbon Debt

Joseph Fargione,¹ Jason Hill,^{2,3} David Tilman,^{2*} Stephen Polasky,^{2,3} Peter Hawthorne²



Accounts for carbon emissions
From land clearing for biofuels

CO2 emissions from land clearing =
difference in carbon between:



—



=

CO2
emissions

$$\begin{array}{rcccl} 286 & - & 160 & = & 126 \\ \text{tons CO}_2/\text{ha} & & \text{tons CO}_2/\text{ha} & & \text{tons CO}_2/\text{ha} \end{array}$$

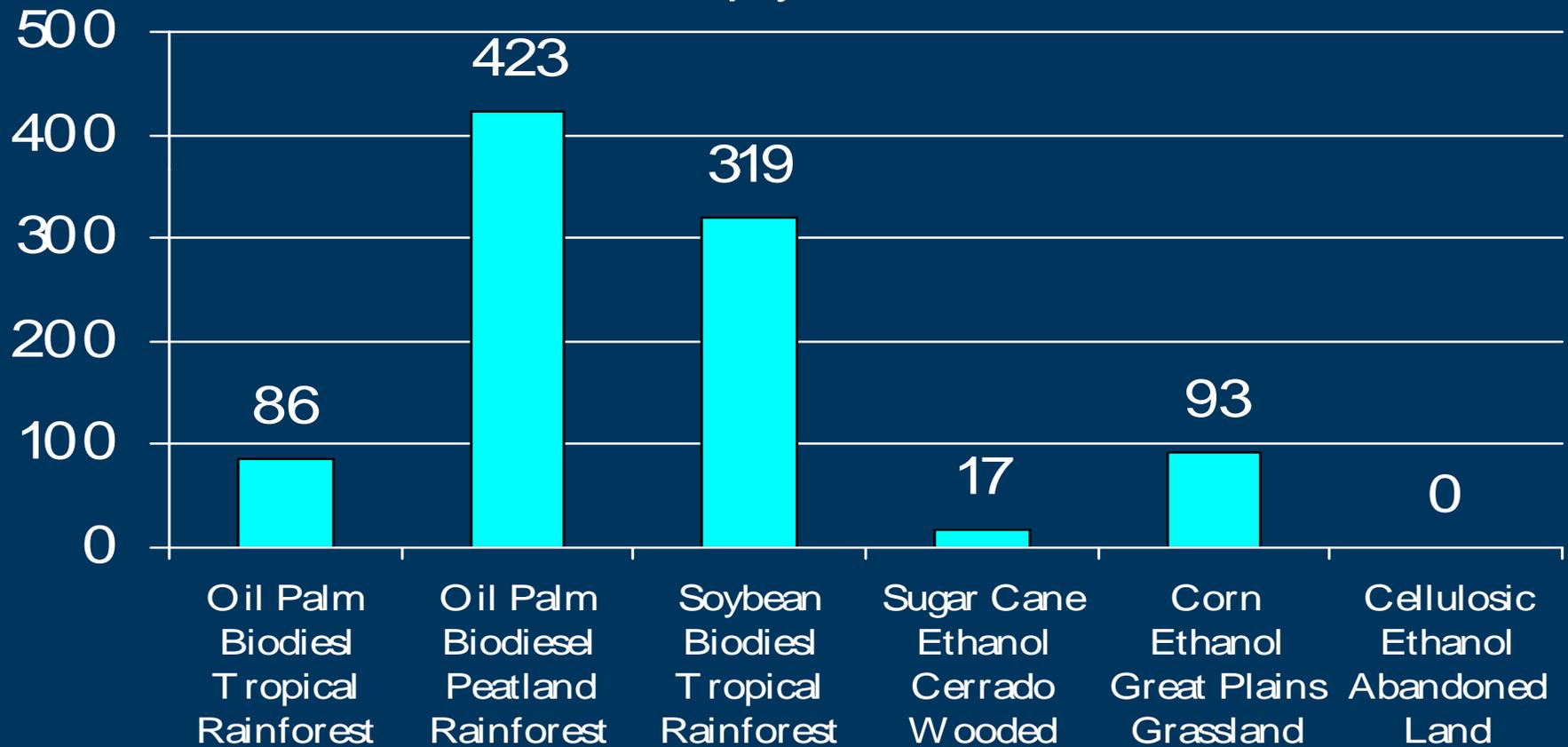
Land clearing releases more carbon than is saved by biofuels

When grassland
is converted to corn
the carbon released is 93 times
the amount of carbon saved
by the ethanol
from one year's worth of corn

Biofuel Performance

Land Use Change Emissions

Years to Repay Carbon Debt



Source: Fargione et al. 2008

Council on Sustainable Biomass Production

Biomass feedstock producers: Monona Farms, Prairie Lands Bio-Products Inc., and Show Me Energy Cooperative

Leading environmental organizations: Ducks Unlimited, Environmental Defense Fund, National Wildlife Federation, Natural Resources Defense Council, The Nature Conservancy, NatureServe, and Theodore Roosevelt Conservation Partnership

Major oil and gas companies: BP, Chevron, and ConocoPhillips

Biomass feedstock crop developers: ArborGen LLC, Ceres Inc., and Mendel Biotechnology Inc.

Biofuel refiners: Verenum Corp. and ZeaChem Inc.

Major forestry corporation: Weyerhaeuser Corporation

Principles for Sustainable Bioenergy

- Reduce greenhouse gas emissions
- Prevent conversion of native ecosystems
- Protect biodiversity
- No invasive feedstocks
- Maintain water quality and quantity
- Minimize chemical inputs
- Protect soil health
- Biotechnology must improve performance
- Do not impair food security
- Respect land tenure and labor rights

Thanks

