

(In)appropriate Technology in Agriculture

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Multidisciplinary Perspectives on Appropriate Technology

Inappropriate Technology in Agriculture

- Agricultural R&D is highly concentrated (e.g., ~ 50% private investment in the US)
- Technology is context-specific and designed for production in particular environments
 - Selecting seeds resistant to local pests and pathogens
 - Developing heat or drought resistant plant varieties

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- The idea that rich-world technology is inappropriate elsewhere motivated the Green Revolution (1960s-80s), a concerted effort to develop seeds for tropical environments
- Yet today, global agricultural productivity gaps remain staggering, dwarfing those in manufacturing, and show no sign of closing in many parts of the world

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- Yet today, global agricultural productivity gaps remain staggering, dwarfing those in manufacturing, and show no sign of closing in many parts of the world
- To what extent is technology today designed “for” rich-country characteristics? And to what extent does this uneven focus of innovation underly differences in productivity?

Inappropriate Technology in Agriculture: An Example



Inappropriate Technology in Agriculture: An Example



European Maize Borer
Dominant threat: **US, Europe**
BioTech Patents: **5,007**
Effective GM Variety ✓



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Maize Rootworm
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Maize Stalk Borer
Dominant threat: **sub-Saharan Africa**
Unique BioTech Patents: **5**
Effective GM Variety **✗**

Innovation Targets Rich-World Ecology: Systematic Evidence

Data: Global distribution and host-plant specificity of all known crop pest and pathogens (CPPs) from the Center for Agricultural Biosciences International

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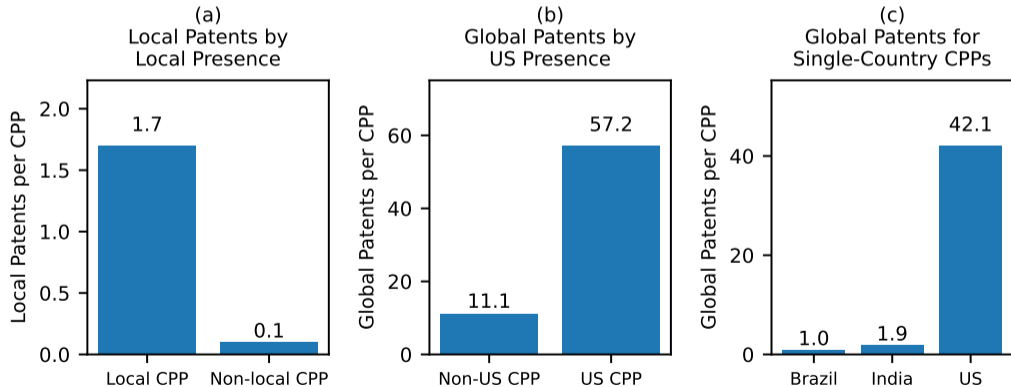
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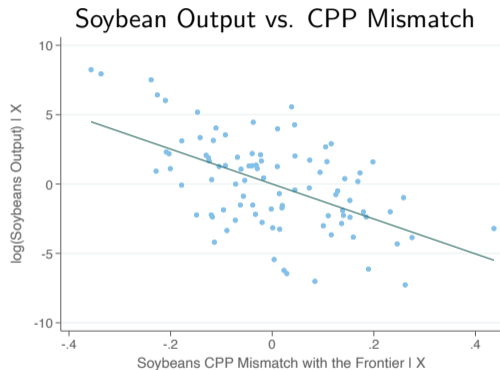
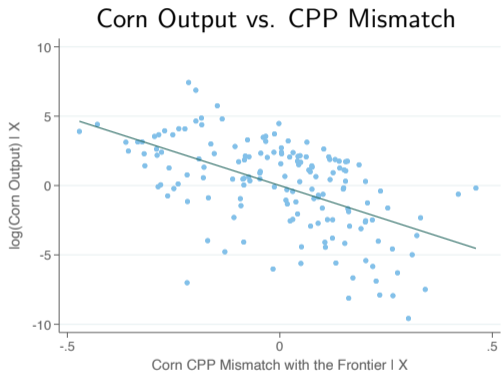
Source: Moscona and Sastry (2022), "Inappropriate Technology: Evidence from Global Agriculture"

Ecological Mismatch with R&D Hubs Substantially Lowers Output

CPP Mismatch = dissimilarity in crop-specific CPPs between each country and R&D leader

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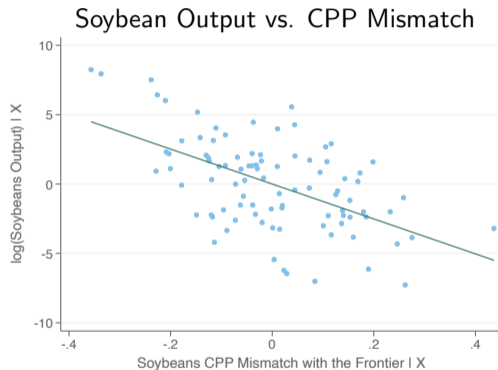
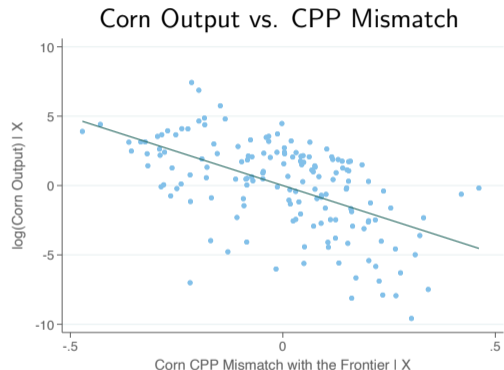
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- CPP Mismatch reduces output across all crops / countries (1 SD \nearrow \implies 0.5 SD \searrow output)
- Ecologically-inappropriate technology **explains 15% of global productivity differences**

Source: Moscona and Sastry (2022), "Inappropriate Technology: Evidence from Global Agriculture"

Application: Agricultural Technology for Climate Change Adaptation

- R&D has responded dramatically to crop-level extreme temperature exposure in the US, mitigating its economic impact (Moscona & Sastry, 2023)
- But **no evidence that R&D responds to temperature changes in the rest of the world**

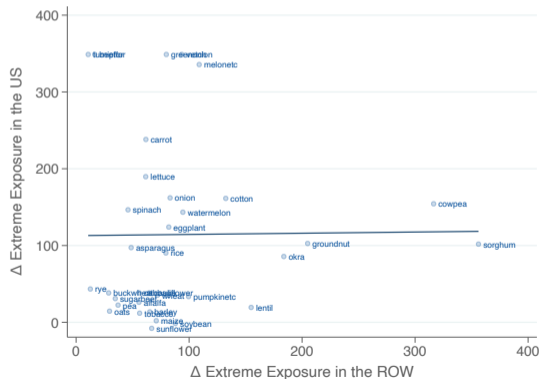
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How effective will US-centric technology be for global adaptation?

Some early-stage cause for concern...

No correlation between crop-level extreme temperature exposure in the US and in the rest of the world



Source: Moscona and Sastry (2023), "Does Directed Innovation Mitigate Climate Damage?"

Inappropriate Technology and the Future of Agriculture

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1 Rise of new R&D leaders

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2 Changes to scientific toolkit

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Pace and direction of these changes matter, especially with climate change looming...

Bibliography

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