Agricultural Technology Adoption Initiative

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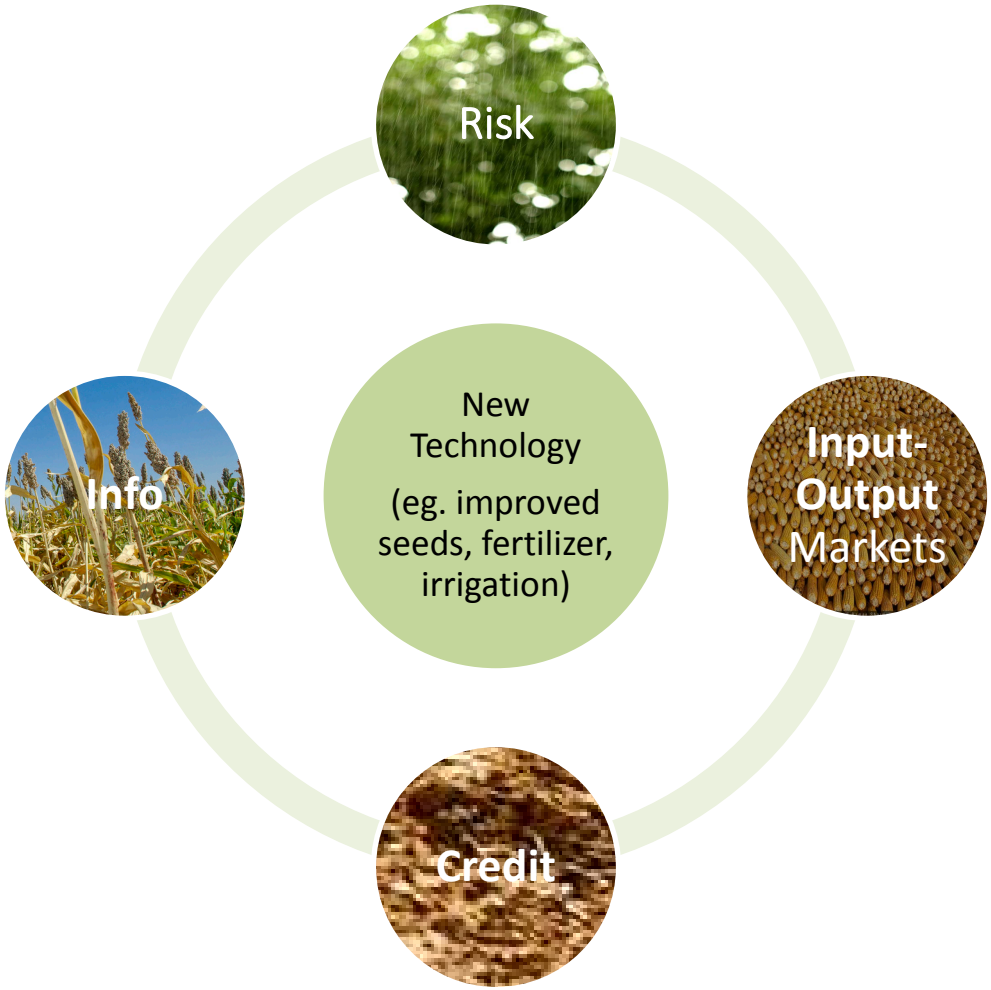
TRANSLATING RESEARCH INTO ACTION

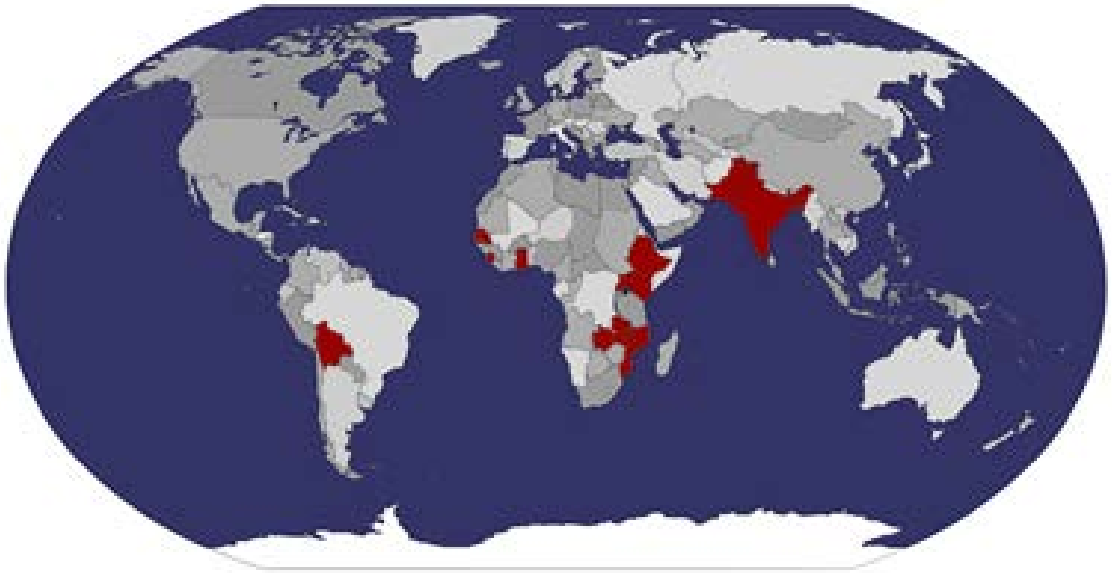
ATAI in Brief

- Why don't smallholder farmers adopt proven technologies?



ATAI in Brief

- ATAI conducts randomized controlled trials to evaluate interventions designed to overcome barriers to technology adoption
- 34 unique trials
- 13 countries
- $9M awarded



What complementarity between agronomic and RCT-based social science research?

Impact Evaluation of flood and drought-tolerant rice

Alain de Janvry | UC Berkeley

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ATAI Hypotheses for Agriculture in Sub-Saharan Africa and South Asia:

- H1: Many good technologies remain **under-adopted**, reducing the essential contribution of agriculture to growth and perpetuating poverty
- H2: Using **RCT-based social science research** can help reduce under-adoption and enhance the gains from adoption

Presentation Overview

- Case of STRASA/ATAI research on rice **flood/drought** tolerance
- Research on **flood** tolerance more advanced than on drought tolerance in both STRASA and ATAI
- Report here the **RCT-based answers to 5 Social Science questions**
- Use responses to show the **value added** by RCT-based social science research to agronomic research

- **Team**

  Kyle Emerick, Tufts University

  Manzoor Dar, IRRI-STRASA/India

  Elisabeth Sadoulet and Alain de Janvry, UC Berkeley/CEGA

- **Financial support**

  50%: ATAI/BMGF

  50%: USAID, 3ie, World Bank, CGIAR-SPIA, AXA

The Broader Problem

- India and Bangladesh: **flooding** affects 16% of rice cultivated area (8.8 million ha) and **drought** 20% (10.6 million ha)
- Little agronomic research on **resilience** to extreme events
- **Climate change**: rising incidence of extreme floods and droughts
- Most of the rice produced in **small farms** 0.5-3ha
- Hence, rice closely associated with rural **poverty**, vulnerability, hunger

Technological Process

- **Flood**-tolerant rice variety: Swarna-Sub1
- **Drought**-tolerant rice varieties: Sahbhagi Dhan, BRRI Dhan 56, IR64Drought
- **No-penalty** under non-stress conditions (experimental plot results)
- Released by **IRRI/STRASA** and India-Bangladesh NARS since 2010

Social Science Question #1:

How large is the yield protection effect in farmers' fields when flooding occurs?

First RCT experiment, first year results

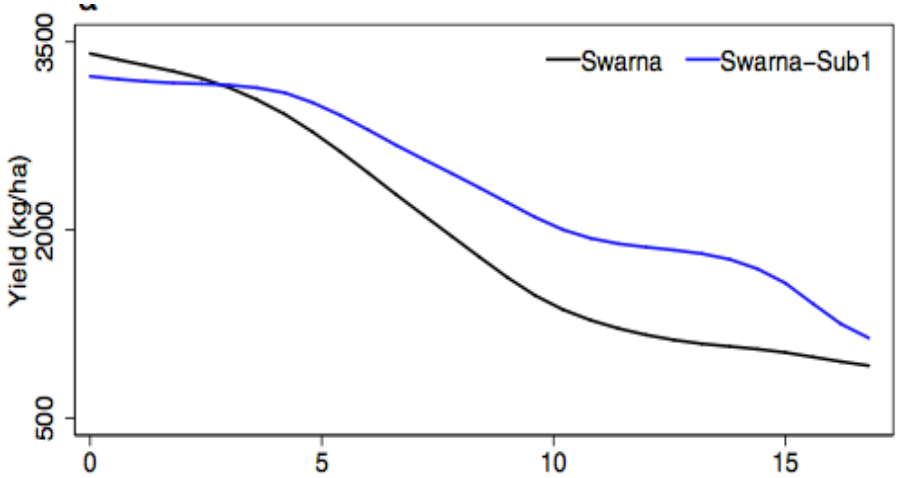
- Select 128 rice-producing **villages** in Odisha India
- Identify 25 Swarna rice producing **farmers** in each village
- Random draw of:
  - 64 **Treatment** villages: Random allocation of 5kg minikits to 5 farmers
  - 64 **Control** villages
  - Control farmers: 5 in each control village, 10 in each treatment village (spillover effects)
- **Kharif 2011**: Large floods → Verify flood tolerance in farmers' fields
- First **survey** of 1248 farmers after harvest

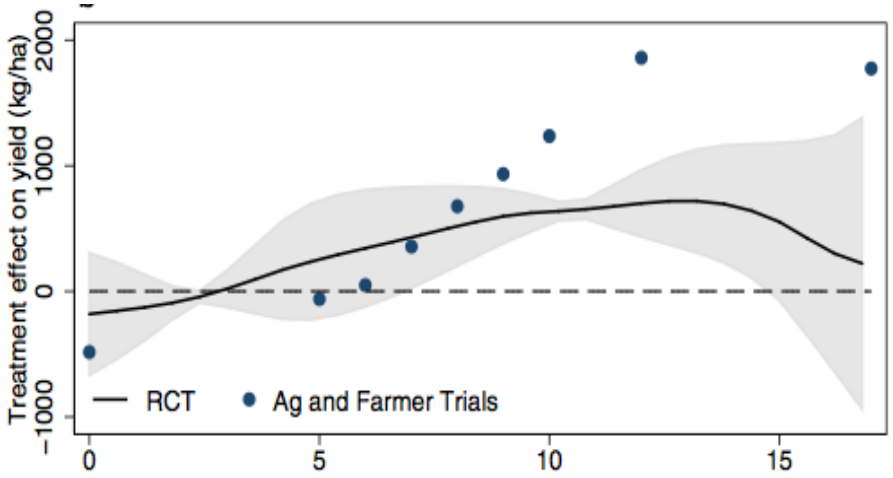
Treatment Group: Swarna-Sub1 Minikits

Exposure to Shock: Farmer inspecting his flooded rice field in Odisha

Yield outcome: Swarna and Swarna-Sub1 in farmers' fields after flooding

Yields by days of flooding





Efficiency effect

- No yield penalty with no flooding: **superior technology**
- **45%** yield advantage after 10 days submergence
- Avoided yield loss = **682 kg/ha**
- Gains in farmers' fields less than in experimental trials that maximize yield

Equity effect

- Plots cultivated by **Scheduled Castes**: 21% more flood days
- Historical process **of social exclusion**
- Shock-coping effect benefits most the **poorest**

Answer to Social Science Question #1

- Flood tolerant rice varieties give yield protection against flood shocks in farmers fields: large even if less than on experimental plots

- Greater benefits for the most exposed to floods, which happen to be the poorest Scheduled Castes

- Technology induces both efficiency and equity gains

Social Science Question #2

Do farmers adjust their behavior to risk reduction?

First RCT experiment, second year results

- Kharif 2012: No floods. Any changes in outcomes due to management decisions in response to risk reduction
- Second survey of same farmers
- **Area** planted: 10% increase in rice area
- **Management practices**
  - 11% increase in **fertilizer** use, esp. early in the growing season
  - 15% less use of low return, low risk "**traditional** varieties" for self-insurance
  - 33% more use of **labor-intensive** transplanting (as opposed to broadcasting)
  - 10% increase in **yield** = 283 kg/ha
- **Credit**: 36% increase in **credit** use
- **Precautionary Savings**: 5 % points less **savings** of rice for future consumption

Answer to Social Science question #2

RCT gives evidence that farmers' behavioral responses to risk reduction crowd-in other investments and other technological changes, enhancing yield returns from agronomic research by 41%

Back of the envelope calculation

- If one flood year every 3-4 years:
- Gain flood year (ex-post agronomic avoided loss) = 682kg/ha
- Gain normal years (ex-ante behavioral response) = 283kg/ha x 2 to 3 = 566 to 849 kg/ha
- Over time, behavioral gain is about equal to agronomic gain

→ **Behavioral gain doubles the gain from agronomic research**

A **second RCT** for **drought-tolerant** Sahbhagi Dhan (over much broader geographical area due to covariate rainfall shocks) in progress

Social Science Question #3:

Is farmer-to-farmer diffusion effective?

Is there more demand than farmer-to-farmer diffusion satisfies?

A third RCT

- 82 villages in Odisha
- In all villages, 5 random farmers received a minikit
- One year later, RCT:
  - Treatment 1: ½ of villages, do nothing. Observe diffusion through **farmer-to-farmer networks**
  - Treatment 2: ½ of villages, **door-to-door sales** to measure demand at market price

Results

- **8%** adoption through social networks vs. **40%** through salesmen
- Adoption through social networks **biased** toward people with the same name
- Even for them, much **lower diffusion than demand**

Answer to Social Science Question #3

Observe that:

- Demand much higher than what happens through the F-to-F diffusion
- Door-to-door sales work better than social networks for diffusion, suggesting a role for organized farmers' seed markets and agro-dealers.

Policy implications:

- **Supply-side** barriers are important
- Formalize **market** relations: salespeople, village seed fairs, agro-dealers
- **Random** selection of **entry points** for farmer-to-farmer diffusion not effective
- Need identify the **best entry points** for farmer-to-farmer diffusion

Social Science Question #4

How to choose village entry points for minikits to best activate farmer-to-farmer seed diffusion?

India Minikit approach: One for every 50 ha of rice (1 for 35 farmers)

- Mainly distributed through village Ward member

A fourth RCT with three arms

94 villages, 5 minikits per village

- T1: Give minikits to **village Ward member** for distribution in the community (status quo)
- T2: Give minikits to women in **village Self-Help Group meeting** for distribution to members
- T3: Give minikits to participants in **village meeting** (mainly men)

Survey of 3,000 farmers

Early Results on Seed Allocation

- Selection of recipients **similar** through local political figure and village meetings
- **Women** more benefited through SHG. Seeds reach poorer people, less leakages to political figures
- But SHG members **transmit less seeds** to next crop season

→ Efficiency-equity trade-off

Answer to Social Science Question #4

Choice of entry points in distributing new seeds (political representative, women self-help groups, lead farmers) makes a difference for subsequent farmer-to-farmer diffusion, with efficiency-equity/gender trade-offs

→ Need give **training** in seed management to women for win-win

Social Science Question #5

Are there spillover effects on labor and water markets?

- Empirical regularity: weather shocks **destabilize** the labor market
- Weather insurance protects farmers but **further destabilizes** the labor market
- ATAI proposition: risk-reducing technology reduces employment shocks and shares benefits from technology with farm workers

Fifth RCT

Distribute minikits of IR64Drought replacing IR64 in Jharkhand

- **Treatment**: 100 villages, minikits to the largest 16 farmers (employers)
- **Control**: 100 villages

Use monthly phone calls to construct workers employment diaries

Analysis in progress

Social Science Question #5

Are there spillover effects on labor and water markets?

Sixth RCT (in progress in Northwest Bangladesh)

- Spillovers of drought resistance on local water markets

Hypotheses:

- BRRI Dhan 56 **reduces** water demand
- **Smoothes** timing of water demand
- **Environmental** benefits on water use and depletion aquifers
- Differentially benefit **poorer** farmers without own tube well

Answer to Social Science Question #5

- Expect to find that risk reduction for farmers spills over onto labor markets (and perhaps also water markets), benefiting the poorest rural people

Conclusions and policy implications

Supply Side

Under-investment in R&D

- Estimation of **rate of return** from investment in R&D based on direct yield effect (agronomic research) badly under-estimated if behavioral spillover effects (social science research) are not accounted for

Need superior technology for adoption

- No yield penalty in normal years and substituting similar seeds currently in use

Need take experimental science to the field through RCT

- Yields in farmers' plots (behavior to maximize welfare) different from experimental plots (set to maximize yield)

Conclusions and policy implications

Demand side

Use technology as a trigger: Adoption of superior risk-reducing technology as a trigger for adoption of other technological and institutional innovations

Assist behavioral responses through complementary interventions to amplify crowd-in effects:

- Access to **credit** for complementary investments and labor costs
- **Training** in seed management for **women**
- Better **targeting** of entry points in F-to-F diffusion
- Make seed **markets** work better: agro-dealers, seed fairs

Overall Conclusion

Large payoffs from RCT-based social science research (ATAI) complementing agronomic research (STRASA)