CGIAR

Standing Panel on Impact Assessment

CGIAR impacts on climate and nutritional outcomes: What do we know with confidence?

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Outline

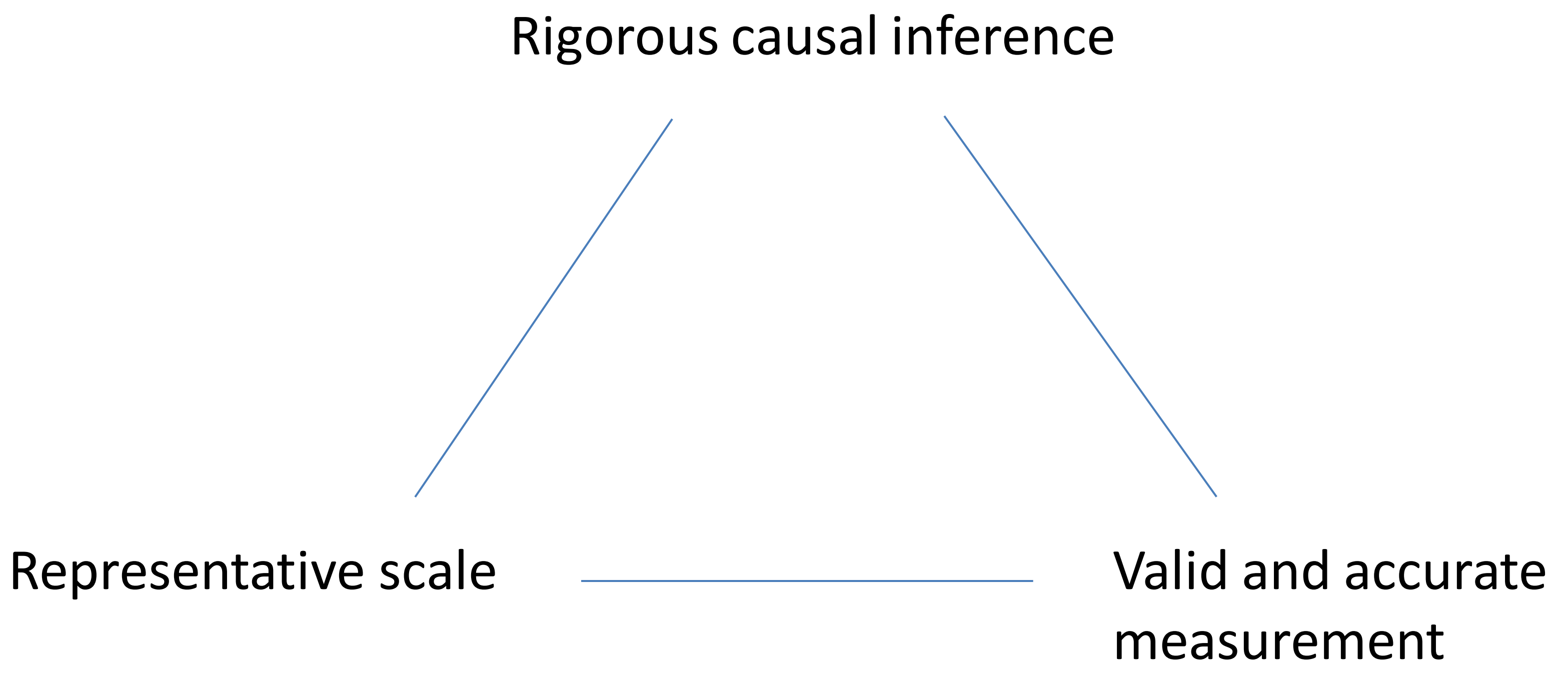
- Introduction: what is required to "know with confidence" about research impact?
- Nutrition
- Climate
- What not talking about?
  - Impacts related to other outcomes such as poverty, livelihoods, gender, youth, social inclusion
  - Influence of CGIAR's nutrition and climate research on policy discourse, agendas or changes
- Conclusions

NB: IA evidence and forward and backward looking & recent Nobel prize

Introduction: The rigor revolution in impact assessment

- There are typically trade-offs among these study design features in impact assessments:

  => Logical sequence of studies



Nutrition and health

- Large benefits in the past via contributions to productivity and income
  - Latest evidence with rigorous methods for causal identification, national representative data sources & remote sensing:
    - 84 countries, 10 crops: 10% increase in HYV => increase life expectancy by 1.34 %
    - 37 countries, infant mortality : 3-5 million infant deaths averted per year

- Despite these contributions, undernutrition is still a problem so the question becomes, can agriculture do more to improve nutrition?

  ~ Parallel with conditional versus unconditional cash transfers

  ~ New urgency given increased likelihood of yield shocks and shifts in climate

- Recent promising advances in approaches and evidence base

Gollin, Hansen, and Wingender, 2018;
Fishman et al. 2017

Oxford Univ, University of Copenhagen; Tel Aviv Univ.
Michigan State Univ., UC San Diego, World Bank

Biofortification

- Major CGIAR system-level investment in agriculture-nutrition
- Also great example of how to generate evidence throughout the program cycle—discovery, piloting, scale
  - *Impact-related studies*
    - *Efficacy studies* – crop x micronutrient studies; systematic review of iron crops
    - *Effectiveness studies*– randomized controlled trials (RCTs) provide evidence that biofortified crops can improve nutritional status under real-life (non-clinical, on-farm) conditions
    - *Monitoring* of dissemination; *measuring adoption at scale*
    - *Estimating impact at scale*
  - Other studies testing assumptions along the impact pathway, e.g., consumer awareness/acceptance

Effectiveness studies

- E.g. RCTs on OFSP in Uganda and Mozambique (2006-2009)
  - Encourage OFSP adoption : vine distribution, training & nutrition info
  - Reached 24,000 households (60% targeted farmers choose to adopt)
  - Large impacts on Vitamin A intake by mothers & young children
    - Increased immunity (reduction in diarrhea)
  - Positive effects on Vitamin A persisted 3 years after vine distribution
  - Causal evidence on cost effectiveness of alternative dissemination models
  - Evidence on correlates of adoption

Hotz et al 2012a,b; de Brauw and Jones, 2015, de Brauw et al 2018, de Brauw et al 2019.

HarvestPlus, IFPRI, World Bank, Delhi School of Economics

Documenting delivery at scale

- Varietal release

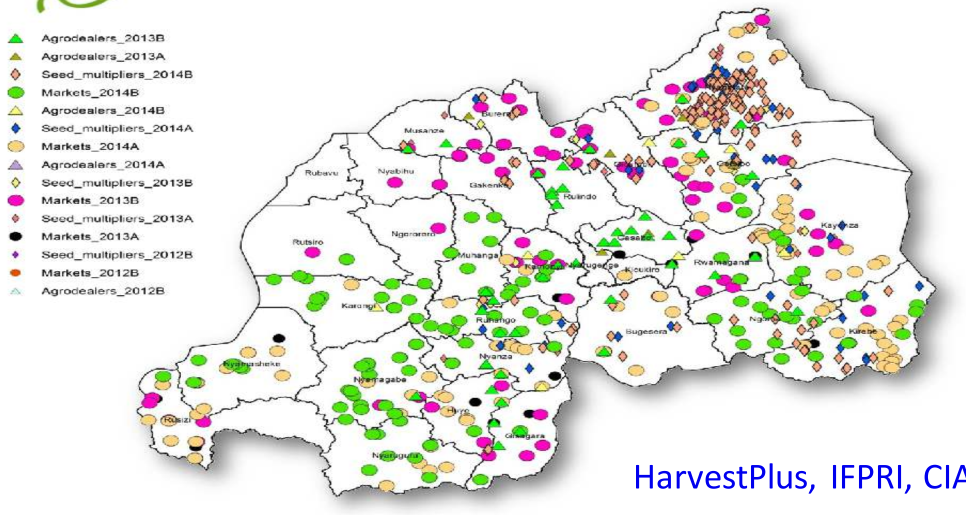
Available high zinc rice varieties

Year	Variety	Grain type	Yield (MT/ha)	Life cycle (days)	Zinc (mg/kg)	Zinc+ (mg/kg)	Cropping season
2013	BRRI dhan-62	Long slender	4.0-4.5	100	22	6	Aman (rainfed)
2014	BRRI dhan-64	Medium slender	6.0-6.5	150-152	24	8	Boro (Irrigated)
2015	BRRI dhan-72	Medium slender	6.0-6.5	125-130	22.7	6.5	Aman (rainfed)
2015	BRRI dhan-74	Medium bold	7.0-7.5	145-147	22.7	6.5	Boro (Irrigated)
2016	BU Hybrid Rice1	Aromatic long slender	5.0-5.5	112-115	21.8 Zn 9.75 Fe	5.8	Aman (rainfed)
2016	BU dhan2	Aromatic long slender	4.5 Aus 5.0 Aman 6.0 Boro	115 Aus 120 Aman 145 Boro	22.2 Zn 11 Fe 8% protein	6.2	All 3 seasons
2017	BRRI dhan-84	Medium slender	6.5	140-145	27.6	11.6	Boro (Irrigated)
2017	BINA dhan-20	Long slender	4.5 (max 7)	125-130	27.5	11.5	Aman (rainfed)

Research → Seed Production → Delivery → Commercialization → Communication & Advocacy

- Dissemination by HarvestPlus and partners

IB dissemination since 2012 B



Bashar, Lividini and Herrington, 2019; Herrington, nd

HarvestPlus, IFPRI, CIAT, Virginia Tech, RAB

Large scale adoption evidence

- Nationally-representative surveys
  - Zinc rice - Bangladesh
  - Iron beans – Rwanda
  - OFSP – Zambia, Uganda, Ethiopia, Malawi (2019-2020, SPIA)
- Sub-national (in areas where delivery took place)
  - Yellow cassava – 4 states in Nigeria
  - Iron beans and orange maize – 12 districts in Zimbabwe
- Data can be used with models to estimate impacts on nutritional outcomes
- Ongoing (SPIA): causal evidence from studies of large scale impacts

Bashar, Lividini and Herrington, 2019, Asare-Marfo et al, 2016, HarvestPlus M&E team, 2018; HarvestPlus M&E team, 2019

HarvestPlus, CIAT, IFPRI, Virginia Tech, RAB

Diets & homestead food production

- CG research contributing to innovation and intervention design (scaling through development partners)
- Programs often included approaches to promote production diversity and increase access to—and consumption of—nutrient-rich foods
  - Targeting families with young children (first 1000 days window)
- In general, successful in raising production and consumption of nutrient rich foods
  - Increase in dietary diversity
- Impacts: Reduction in anemia, underweight, diarrhea
  - Complementarity with other programs (WASH)

Key messages ~ nutrition

- If nutrition is a goal, target nutrition
  - Prioritize the research design
- Scaling innovations & their impacts is challenging
  - HarvestPlus example is very good for discovery and piloting phase
    - And note the timeline (10 plus years)!
  - There are lessons here for other innovations, where the innovation itself or the context in which it is expected to diffuse is complex…

    (~ SPIA learning studies)

A final nutrition example

- RCT : Early-maturing upland rice variety in Sierra Leone
  - distributed for free in random treatment villages,
  - with or without training (on land preparation, crop husbandry, post-harvest activities)
- Rice yields increased, but only for households offered both seeds and training
  - NERICA-3 sensitive to moisture during germination. Farmers who received only seeds more likely to report germination and crop failure issues compared to control
- Seed and training only
  - Harvest 5 weeks earlier than control group (at peak of hungry season)
  - Higher-level health and nutrition outcomes
    - Improvements in weight-for-height (0.5 SD) and BMI-for-age (0.8 SD)
  - Impacts persisted over time

Glennester and Suri, 2018

Climate (mitigation)

- Studies have documented some evidence on environmental gains
  - 84 country paper generally finds support for Borlaug hypothesis
    ~ land use changes. But results are context-specific
  - Agroforestry project with positive impacts on forest cover

- But till recently:
  - Studies don't measure environmental outcomes, positive or negative
    - Ongoing set of SPIA studies led with Emlab (remote sensing, measurement, …)
  - And…

Gollin, Hansen and Wingender. 2018;
Hughes et al, 2018

Oxford Univ, Univ of Copenhagen;
ICRAF/FTA, Univ of Illinois

Farmer adoption of plot- and farm-level natural resource management practices: Between rhetoric and reality (Stevenson et al, 2019, Global Food Security)

- 9 recent adoption studies (reported in Stevenson and Vlek, 2018) find consistently low adoption despite prior claims of "success"
  - Results from agronomic trials suggest that scaling up plot- and farm-level natural resource management (NRM) practices can be a key element of sustainable intensification

- Five recommendations for NRM research (Feb 2018 SPIA/PIM workshop):

1. Accurately identify and target farmers based on their idiosyncratic needs and circumstances
2. Explore better scaling-up strategies ~ complexity
3. Play the role of information provider / knowledge broker
4. Carefully consider the expected long-term trajectories for diffusion of NRM practices
5. Measure and report the impacts of on-farm NRM practices on environmental outcomes

Climate adaptation (resilience)

- Conceptual and empirical challenges of rigorously measuring risk reduction and resilience
  - Many different types of shocks, relevant ones don't always occur in study period/area
  - Behavioral adjustments often hard to predict
    - In part because farmers may not make same mean-variance calculation as researchers (and prices matter too!)
    - And learning re new technologies is difficult given vulnerability to different shocks
  - Current area of focus for SPIA

- What do we know from other studies of impacts of innovations seeking to reduce risk, especially weather related risk?

Impacts of conservation agriculture in Zimbabwe

- CA with multiple crops;
  - technical training and support for inputs purchase
  - extension agents, NGOs, ag research stations
- Intensity of promotion varied spatially and over time → source of variation in adoption
  - Panel data (4 years, 2007-2011) – yield, inputs, diffusion efforts
  - Rainfall data at suitable resolution – in this case, satellite imagery with in-situ station data (CHIRPS)
- Results :
  - Mitigates yield losses with high and low rainfall
  - BUT: similar or possibly lower yields during periods of average rainfall compared to conventional practices.
- Environmental outcomes (e.g., soil fertility): not measured

Michler et al, 2018

Univ. of Illinois and ICRISAT

2 RCTs on stress-tolerant rice in S Asia

- Swarna-Sub1 in India: Flood tolerant rice variety – randomly distributed minikits
  - Reduced downside risk, increased yield even in non-flood years (10%)
    - Why? Crowding in of other inputs: positive effects on area cultivated, fertilizer used (10%), credit demand (36%), and adoption of a more labor intensive planting method(33%)
- BD 56 in Bangladesh: Early-maturing, drought-tolerant rice variety – random minikits
  - Returns to BD56 high only when farmers take advantage of its early maturation period to plant a second crop post-Aman, followed by a third (Boro) crop
  - Without planting the second crop, farmers incur a large yield penalty (43%) due to BD56's short duration
  - However, BD56 farmers were only about 28% more likely to grow a third crop, with larger farmers twice as likely to do so
    - Other constraints: coordination, information, …

Dar et al, 2013; de Janvry et al. 2017

Bundling drought tolerant maize (DTM) and weather insurance, Mozambique and Tanzania

- RCT : bundling to expand drought protection for small-scale farming families
  - RCT: DTM seeds, DTM seeds plus insurance (for seed replacement), control.

  Results:

  - DTM seeds offer a modest 12% yield advantage in normal years and insulate farmers against the negative consequences of mid-season drought.
  - For farmers without DTM, yields fall by 15% after a mid-season drought, with higher food insecurity in the following year.
  - While DTM seeds do not insulate farmers against severe shocks, farmers with DTM seeds bounce back from a severe shock. This is especially true for farmers with insured seeds.

Boucher et al. 2019

CIMMYT, UC Davis

Alternate wetting and drying (AWD)

AWD controlled trials: large gains in profits and water saving.

Yet very low adoption (e.g. 2% Philippines)

2 RCTs testing the impact of AWD on water management:

- Philippines: No statistically significant impacts on yields, income, or change in management (size of rice parcel, irrigation frequency).
- Bangladesh: no statistically significant impact on water use.

  <u>Restricting to subsample of volumetric water pricing treatment</u>: water use savings in line with agronomic trials (19%), profit increase (7%).

Follow-up RCT: randomly change marginal pricing for water to test the effect on AWD demand:

- Increased demand for AWD technologies for higher prices.
- **Message: Farmers don't value a water-saving technology in case of zero marginal price of water.**

Rejesus et al. 2017, Chakraworty et al. 2019

IRRI, NCSU, Tufts

Index-Based Livestock Insurance (IBLI)

IBLI policies have provided coverage for over 300,000 cattle equivalents in Northern Kenya and Ethiopia

- in part through integration in public social protection system in Kenya

Several studies on local impacts of IBLI, using RCT with discount coupons

- Strong and positive impacts on preserving productive assets, and increasing subjective, economic and health well-being after severe drought in Kenya
- The marginal benefit/cost ratio of IBLI substantially exceeds that of unconditional cash transfers
- Uptake : more than 40% of the sample with subsidy, but only 4% without
- Lessons on gender and social inclusion

Ongoing SPIA work:

- Long-term& large scale impacts on household welfare and environmental outcomes (~ remote sensing)

Janzen et al. 2013, Chantarat et al. 2018, Jensen et al. 2017, Bageant et al. 2015

ILRI, Cornell Univ., Syracuse Univ., BASIS, UC DAVIS, GRIPS(Japan)

Key messages ~ climate adaptation

- Smallholders' reluctance to adopt climate-smart practices
  - may be rational given their costs to implement (inputs, labor), prices, performance during times of normal rainfall, and complexity
- Need careful targeting and complementary policies
  - Subsidies may be justified; especially if there are environmental benefits not captured by the farmer
- Role for early-stage impact assessment (learning studies)
  - Can help to predict how people/farmers respond to innovation at scale
  - Responses not necessarily easily mapped out in product profiles

SPIA workplan update

- SPIA's 3+3-year workplan is organized around three objectives:
  - Support CGIAR's strong commitment to embed a culture of impact assessment (IA)
  - Expand and deepen evidence of impact of CGIAR research investments
  - Improve and institutionalize collection of data on diffusion and use of CGIAR innovations in national data systems
- SPIA remains committed to delivering on its mandate and on the full 3-year program of work approved by System Council at SC7.

Item of note:

➢ Revisions in the distribution of tasks/funds over the first 3 years of the 3+3-year SPIA plan