Co-designing a relevant basket of options for climbing bean cultivation in Uganda

Esther Ronner
Katrien Descheemaeker
Conny Almekinders (KTI)
Peter Ebanyat (IITA Uganda)
Ken Giller

WaCASA lunch meeting
8 November 2017
In first chapter PhD:

- Technologies work on research stations, not necessarily on farmers’ fields
- Widespread testing on farmers’ fields
- Understanding variability in yields to find niches for legume technologies

Soybean in Nigeria:

- Control
- + P-fertilizer
- + Inoculation
- + P-fert. + inoc.
Results soybean in Nigeria, 2011 and 2012

Putting nitrogen fixation to work for smallholder farmers in Africa
Background PhD research

• In general:
  – P + Inoculants largest yields (and profitability)
  – Planted early and weeded in time

→ Ideally adopted by all farmers growing soybean

• But in reality not all farmers apply ideal combination
  – Capital, labour constraints
  – Land constraints (intercropping)
  – Other priorities (other crops, maximizing or optimizing yield)?
Theoretical framework

• Diversity of farmers with different objectives, possibilities and constraints

• Develop relevant options for different types of farmers
Theoretical framework

• Through a “co-design” process
  – Understand objectives and preferences of the users of a technology
  – Which criteria do users of the technology use to determine which options are ‘best’?

• Understand use and adaptation of options developed through co-design process
Applied to climbing beans in Uganda

Option for densely populated highland areas of Uganda

• Bush bean: 3 t/ha; climbing beans: 4 to 5 t/ha

• New technology
• Change in cropping system
• Need for staking
Objective 2: co-design a basket of options

- Develop and apply a **co-design process**, resulting in relevant **basket of options** for farmers in different **contexts**:
  - Geographical regions in Uganda (agro-ecology, market access, input use, access to trees for staking, history of climbing bean cultivation)
  - Socio-economic background, gender
Co-design process

Consultation
Characterization → First design

Testing
Evaluating
Re-design

3 cycles

Testing in demos

Evaluations (per farm type)

Re-design sessions

Putting nitrogen fixation to work for smallholders
Characterization and design of first options

- Started in eastern highlands
- Characterization: staking main constraint
- Treatments in demonstration:
  - Different staking methods
  - Varieties (local and improved)
  - Inputs (manure and TSP fertilizer)
  - Researcher best-bet (improved variety; manure + TSP)

Images:
- Single, wooden stakes
- Strings (sisal or banana fibre)
- Tripods
Testing and evaluating: season 2014A

Varieties and inputs

<table>
<thead>
<tr>
<th>Variety</th>
<th>Climbing bean grain yield (kg ha⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No inputs</td>
<td>2000</td>
</tr>
<tr>
<td>Manure + TSP</td>
<td>3000</td>
</tr>
<tr>
<td>Kabale local</td>
<td></td>
</tr>
<tr>
<td>NABE 26C</td>
<td></td>
</tr>
</tbody>
</table>

Staking methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Evaluation score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single stakes</td>
<td>-0.5</td>
</tr>
<tr>
<td>Banana fibre</td>
<td>0.5</td>
</tr>
<tr>
<td>Sisal</td>
<td>0.0</td>
</tr>
<tr>
<td>Tripods</td>
<td>-0.5</td>
</tr>
</tbody>
</table>

Putting nitrogen fixation to work for smallholder farmers in Africa
Testing and evaluating: 2014B and 2015A

Varieties

Inputs

Staking methods
Evaluating: reasons for preference

Consultation
Characterization ➔ First design

Testing ➔ Evaluating
Evaluating ➔ Re-design
Re-design ➔ Co-design
Putting nitrogen fixation to work for smallholder farmers in Africa
Putting nitrogen fixation to work for smallholder farmers in Africa
Putting nitrogen fixation to work for smallholder farmers in Africa

2015A:
- Yield important, some other criteria more
- Home consumption: costs & benefit/cost ratio more important (than farmers producing for sale)
- Lots of variability/inconsistency
## Basket of options

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Improved variety</th>
<th>Additional options</th>
<th>Reasons for preference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Improved variety</td>
<td>Multiple varieties</td>
<td>Multiple variety traits</td>
</tr>
<tr>
<td>Inputs</td>
<td>Manure + TSP</td>
<td>No inputs</td>
<td>Costs</td>
</tr>
<tr>
<td></td>
<td>Manure or TSP only</td>
<td>Availability, costs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DAP</td>
<td>Availability, costs</td>
<td></td>
</tr>
<tr>
<td>Staking</td>
<td>Single stakes</td>
<td>Strings</td>
<td>Availability, costs</td>
</tr>
<tr>
<td></td>
<td>Tripods</td>
<td>Strength, labour</td>
<td></td>
</tr>
<tr>
<td>Wooden stakes</td>
<td>Banana fibre</td>
<td>Availability, costs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Papyrus</td>
<td>Availability, costs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maize stalks</td>
<td>Availability, costs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sisal</td>
<td>Strength, re-usability, costs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nylon</td>
<td>Strength, re-usability, costs</td>
<td></td>
</tr>
<tr>
<td>Other practices</td>
<td>Sole cropping</td>
<td>Intercropping</td>
<td>Land scarcity, risk reduction</td>
</tr>
<tr>
<td></td>
<td>Row planting</td>
<td>Broadcasting/ random planting</td>
<td>Labour</td>
</tr>
<tr>
<td></td>
<td>One seed per hole</td>
<td>Two or more seeds per hole</td>
<td>Risk reduction, labour</td>
</tr>
</tbody>
</table>
Conclusions

• Broadening scope of technology evaluations from ‘yield’ to multiple criteria improves understanding of relevance of options
  – Take farmer evaluations serious!
    “Farmers evaluate and researchers decide...”

• Disaggregated analysis improved visibility of different preferences and perspectives (who do we interact with??)
  “Only some women will like variety Kabale local”
  “Staking should not be a problem for serious farmers”
Objective 3: Use and adaptation of options

Understand farmers’ **use and adaptation** of the practices included in the co-design process, and use this understanding to inform **technology re-design** and **recommendation domains**

- Use and adaptation monitored:
  - In adaptation trial (farmers receive seed and fertilizer)
  - One to three seasons after adaptation trial (using own seed and fertilizer)
Definition use and adaptation

- Climbing bean technology = complex technology = consisting of combination of practices
- Combination of ‘best yielding’ practices = “researcher best-bet” technology

- Farmers applying researcher best-bet = use (adoption)
- Farmers applying selection of practices = adaptation

Climbing bean technology
- Improved variety
- Manure
- TSP
- Sole cropping
- Row planting
- 160,000 plants per ha
- 40,000 stakes per ha
- Stakes > 1.75m

Adaptation
- Improved variety
- Manure
- TSP
- Sole cropping
- Row planting
- 160,000 plants per ha
- 40,000 stakes per ha
- Stakes > 1.75m
Putting nitrogen fixation to work for smallholder farmers in Africa

Farmers applying options on their own field

- Southwestern
- Southwestern
- Eastern

Adaptation trial
Season after adaptation trial

n=374
n=251
Farmers applying options on their own field

Only 2 farmers used all practices (99% adapted)

Putting nitrogen fixation to work for smallholder farmers in Africa
Putting nitrogen fixation to work for smallholder farmers in Africa

Increase and consistency in use of practices?

Adapted from Vanlauwe et al. (2010)
Which farmers use which practices?

- Poorer farmers planted climbing beans more often → adaptations (varieties, manure, stake length)
- Only farm size consistent positive relationship with use of practices
- Again a lot of variability/inconsistencies...
- ...but surprising? Use of practices also inconsistent!
Conclusions

- Only two farmers used ‘full package’, 99% adapted
- Different farmers used different combinations of practices; few consistent explanatory variables
- Inconsistency in use of practices over time
- Adoption: not binary or linear, but dynamic process → snapshot in time will not tell much
Recommendation domains & variability

• In both studies:
  – Diversity of preferences/ use and links with household characteristics
  – Link to inconsistency in use of practices? (weather, market, access to resources in the right time)

• Instead of packages for recommendation domains
  – Basket of options
  – Sets of practices instead of fixed packages for every farm type
  – Recommendations of how to use practices, under which circumstances

• Inconsistency in use of practices → understanding variability in yield???
Thank you!
Putting nitrogen fixation to work for smallholder farmers in Africa

Outscaling tool: “Option x context matrix”

<table>
<thead>
<tr>
<th>Context</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield maximization</td>
<td>Researcher best-bet</td>
</tr>
<tr>
<td>Risk minimization</td>
<td>Multiple seeds per hole, intercropping</td>
</tr>
<tr>
<td>Home consumption</td>
<td>Multiple varieties, no inputs</td>
</tr>
<tr>
<td></td>
<td>(intercropping in home garden)</td>
</tr>
<tr>
<td>Land constraints</td>
<td>Intercropping</td>
</tr>
<tr>
<td></td>
<td>(banana leaf pruning)</td>
</tr>
<tr>
<td>Labour constraints</td>
<td>Single stakes, broadcasting/ random planting</td>
</tr>
<tr>
<td>Capital constraints</td>
<td>Alternative staking materials,</td>
</tr>
<tr>
<td></td>
<td>single input (manure or TSP/DAP)</td>
</tr>
<tr>
<td>Deforestation</td>
<td>Alternative staking materials</td>
</tr>
<tr>
<td>Good soil fertility</td>
<td>Single input (manure or TSP/DAP)</td>
</tr>
</tbody>
</table>
Use of co-designed options....

- More than half of the farmers used local varieties (marketability, taste, availability)

- Use of P-fertilizer in general very low
  - Only one farmer bought TSP
  - Others used DAP

- Only very few farmers used tripods and strings
  - Difficult to develop options for poorer farmers

- Intercropping and broadcasting more popular than sole cropping and row planting
  - Varieties & management recommendations for intercropping
Re-design sessions

- Re-design of treatments for demonstrations next season

- Contributions farmers in re-design sessions
  - Suggestions for cost, labour, risk reduction
  - Request solutions for local problems
  - New research questions to explore
  - Check relevance of proposed solutions

- Research, extension and NGO staff: knowledge and technologies from elsewhere

- Suggestions farmers and researchers compared in demonstrations

Putting nitrogen fixation to work for smallholder farmers
Evaluating: options for different farm types?

- Varieties evaluated similarly
  - Season 2014B: women preferred Kabale local

- Treatment with manure + TSP valued by wealthier farmers, no inputs by poorer farmers & farmers producing for home consumption

- Sisal strings low-cost alternative, but better scores from wealthier farmers
Preference for options added during co-design process

- Varieties: local varieties added as comparison
  - Local varieties received high scores, although yields comparable or smaller
  - Local varieties valued for disease resistance, grain colour, maturity time and suitability for climate
  - Improved varieties valued for yield and grain size

- Inputs: inclusion of DAP in eastern highlands
  - DAP received highest score; better availability than TSP and manure

- Staking methods: strings included as low-cost alternative for poorer farmers
  - Strings consistently received lowest scores (except southwest 2014B)
  - Compared with single stakes: availability of material, additional labour demand, costs, ease of method and re-usability of material all lower scores
Discussion/ conclusions

*Lessons learned from co-design process*

- Individual evaluations easier than groups, but results more variable
- Broadening scope of technology evaluations from ‘yield’ to multiple criteria
- Multiple (stepwise) options have more local relevance than only best-yielding combination of practices
Discussion/ conclusions

Options for different types of farmers

• Finding suitable options for resource-poor farmers difficult
  – Multiple constraints
  – Institutional change required

• Disaggregated analysis improved visibility of different preferences and perspectives (who do we interact with??)
  “Only some women will like variety Kabale local”
  “Staking should not be a problem for serious farmers”

  – Not only best-yielding varieties
  – Intermediate input options
  – Management recommendations for farmers intercropping with banana
Discussion/ conclusions

Applicability in large-scale development project

- Basket of options for East-African highlands
- Basic methodology of testing, evaluation and re-design applicable
  - Use of tablets enables faster feedback loops
  - Make use of household data already collected in project for disaggregated analyses
  - Take farmer evaluations serious! “Farmers evaluate and researchers decide...”
Principles for co-design in large-scale projects

Instead of best yielding technology:
- Range of options
- Stepwise introduction

Adapted from Vanlauwe et al., 2010

Putting nitrogen fixation to work for smallholder farmers in Africa