SIMLESIA End of Project External Review and Stakeholders’ meeting

SIMLESIA Ethiopia
Bedru B.
6–9 March 2018
Beshale Hotel
Addis Ababa
Outline of presentation

- Highlight of SIMLESA 2010 to 2017 results
  - Progresses made and challenges
  - What is remaining issues
SIMLESA Ethiopia

- The program in Ethiopia has two stages:
  - Main SIMLESA - March 2010-CRV, Western Eth., Pawe, Hawassa
  - Expansion SIMLESA - April 2012 – 2013/14 : SARI, ARARI, SoRPARI
- EIAR (federal) & RARIs in 8 RCs
- Major maize-legume growing agro-ecologies (semi-arid, humid, sub-humid, etc.)
- CGS: 3 major maize-legume producing states
- The zones host 33% maize growers 44% maize yield
- CGS: 3 major maize legume producing regional states in 7 zone
Program objectives-Pillars

1. To enhance understanding of CA based SI options
2. Test and adapt productive, resilient and scalable CA-based SI options
3. To increase varieties available to smallholders
4. To support the Dev’t local and regional IP & scaling out modalities
5. Capacity building to increase the efficiency of agricultural research today and in the future

Gender: Men, Women, youth- Equitable benefit
Objective 1

SIMLESA-1

- 84 communities (15 districts) characterized for technology testing and scaling out
- Data on demography, resources, adoption, production, market, risk management strategies, etc
- Major agro-ecologies identified: Semi-arid, humid, sub-humid
- 3-4 functional typologies identified (resource endowment)
- Baseline survey report produced and shared with stakeholders

Production constraints of maize and legumes

- Price of fertilizer
- Availability improved seed
- Prices of improved seed
  - Timely availability of fertilizer
  - Drought
  - Quality of seed
  - Availability of credit to buy fertilizer
  - Availability of credit to buy seed
  - Diseases
  - Access to markets and information
  - Low grain prices
  - Floods
  - Pests
  - Soil fertility decline
## Benefit-cost C summary of CA-based maize and legume production and farmers’ practices across major agro-ecologies in Ethiopia

<table>
<thead>
<tr>
<th>Location</th>
<th>FP sole maize</th>
<th>CA sole maize</th>
<th>MB intercropping</th>
<th>MB Rotation</th>
<th>BM Rotation</th>
<th>% B:C of CA sole maize to FP sole maize</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hawassa</td>
<td>3.48</td>
<td>4.75</td>
<td>6.08</td>
<td>4.99</td>
<td>6.36</td>
<td>136</td>
</tr>
<tr>
<td>Bako</td>
<td>3.67</td>
<td>4.49</td>
<td>3.33</td>
<td>3.90</td>
<td>3.67</td>
<td>122</td>
</tr>
<tr>
<td>Central Rift Valley</td>
<td>3.51</td>
<td>3.95</td>
<td>3.79</td>
<td>2.05</td>
<td>3.51</td>
<td>113</td>
</tr>
<tr>
<td>South Gojam</td>
<td>1.95</td>
<td>2.97</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>152</td>
</tr>
<tr>
<td>Jigjiga</td>
<td>3.32</td>
<td>3.78</td>
<td>4.25</td>
<td>6.73</td>
<td>–</td>
<td>114</td>
</tr>
</tbody>
</table>

- Financial benefit analysis shows that conventional and conservation agriculture practices of **maize-legume intercropping** followed by **sole maize** with fertilizer gave higher margins.

- Figures are in terms of benefit cost ratio from unit area (ha)
Impact of agronomic practices on maize varieties performance and net maize income in Ethiopia

Agronomic practices

Rotation+Minimum tillage+Improved maize varieties
Rotation+Improved maize varieties
Minimum tillage+Improved maize varieties
Improved maize seeds only
Minimum tillage only
Rotation only
Rotation+Minimum tillage

Net maize income (ETB)

5579
4507
2959
2823
2350
1892
498
Objective 2
Long term on station and on farm experiments

Table On-farm long term experiment

<table>
<thead>
<tr>
<th>No</th>
<th>Center</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Melkassa</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>Hawassa</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Bako</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>ARARI</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>SoRPARI</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>SARI</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Sum</td>
<td>52</td>
<td>42</td>
</tr>
</tbody>
</table>
CA-SI effect on yield & reduction in downside risk

• Results of experiments from on station & on farm show that:
  ▪ Growing common bean under CA produced 40% yield advantage while similar experiment for maize was 28% as compared to CP
  ▪ Stover yield of maize increased by 25% under CA as compared to CP while that of common bean increased by 34% (e.g., Central Rift Valley)
CA-SI on yield and reduction in downside risk

- Higher soil moisture content in all soil horizons was recorded under CA.
- Water-use efficiency (WUE) of maize was significantly improved in CA plots as compared to CP plots in low rainfall seasons in both low rainfall and high rainfall areas.
- *WUE was the highest for* common-bean maize rotation:
  - Maize-common rotation
  - Sole maize grown under CA
  - Maize sole grown under CP
# Effect of different tillage and management practices on soil loss at BARC

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Runoff depth (mm)</th>
<th>Sediment concentration (g/l)</th>
<th>Soil loss (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sole maize + Conventional tillage (CT)</td>
<td>44.99&lt;sup&gt;a&lt;/sup&gt;</td>
<td>667&lt;sup&gt;a&lt;/sup&gt;</td>
<td>18.92&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sole common bean - CT</td>
<td>28.39&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>45.17&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>7.03&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td>Maize/Common bean intercropping - CT</td>
<td>22.12&lt;sup&gt;d&lt;/sup&gt;</td>
<td>38.23&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>4.69&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sole maize + mulch - CT</td>
<td>34.13&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>62.63&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.84&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Maize/common bean intercropping – Min-tillage</td>
<td>35.88&lt;sup&gt;cb&lt;/sup&gt;</td>
<td>27.8&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.04&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sole maize + mulch + minimum tillage</td>
<td>40.76&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>48.57&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>9.56&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Mean</td>
<td>34.38</td>
<td>48.18</td>
<td>9.01</td>
</tr>
<tr>
<td>CV (%)</td>
<td>13.93</td>
<td>3.77</td>
<td>33.37</td>
</tr>
<tr>
<td>LSD (0.05)</td>
<td>8.729</td>
<td>33.07</td>
<td>5.47</td>
</tr>
</tbody>
</table>
CA-SI effect on yield & reduction in downside risk

- In terms of land use intensification, maize common bean intercropping under CA gave the highest yield (for both maize and common bean) and the land equivalent ratio (LER).
- From a financial perspective, CA practices were superior over CP.
- Gross margins on CA managed maize were 136% higher than CP maize.

<table>
<thead>
<tr>
<th>No.</th>
<th>Treatments</th>
<th>Maize grain yield (t/ha)</th>
<th>Common bean grain yield (t/ha)</th>
<th>LER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Maize/CB intercropped in CT</td>
<td>7.66</td>
<td>0.07</td>
<td>1.47</td>
</tr>
<tr>
<td>2</td>
<td>Maize/CB intercropped in CA</td>
<td>8.54</td>
<td>0.1</td>
<td>1.77</td>
</tr>
<tr>
<td>3</td>
<td>Sole maize</td>
<td>7.21</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Maize/CP intercropped in CA</td>
<td>8.04</td>
<td>0.07</td>
<td>1.53</td>
</tr>
<tr>
<td>5</td>
<td>Sole CB under CA</td>
<td>–</td>
<td>0.17</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>CB in rotation under CA</td>
<td>–</td>
<td>0.15</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>LSD (%)</td>
<td>NS</td>
<td>390**</td>
<td>0.328*</td>
</tr>
<tr>
<td></td>
<td>CV (%)</td>
<td>15.07</td>
<td>13.3</td>
<td>9.4</td>
</tr>
</tbody>
</table>

Means of grain yield (kg/ha) for maize and first belg beans in permanent plots in Loka-Abaya and Boricha district and southern Ethiopia.
Impact of CA on yield and reduction in downside risk

- With respect to drought risk reduction, CA was found to be more resilient during moisture stress seasons (2012 and 2015).
- Common bean rotation and intercropping with maize under CA gave consistently higher yield than a similar cropping system under CP in the Central Rift Valley of Ethiopia.
- Yield is 4.4 to 7.0 t/ha and 2.6 to 3.1 t/ha.

Among CA practices, **crop diversification has dual impacts using large (5740) set of data**
  - Enhances productivity, and
  - reduces the downside risk in maize production on plots planted to improved maize and/or chemical fertilizer (Moti and Pawel, 2017).
CA increased environmental sustainability

- Soil bulk density reduction was observed in semi-arid Central Rift Valley due to improved soil organic carbon as a result of residue retention and reduced soil compaction in CA systems.

- Increase in soil carbon (SC) and improved soil moisture contents in the semi-arid and sub-moist zones of the Central Rift Valley (Feyera et al., under review) and Western Ethiopia (Zerihun et al., 2014).

Fig. Stored soil water (SW) for the 0-5 cm at harvest and 1 m depths during grain fill, and bulk density (BD) and soil organic C (SOC) for the 0-5 cm depth at harvest time, as affected by the main and interaction effects of tillage and cropping system at Bako and Melkassa, Ethiopia.
Increased environmental sustainability

Result of experiments in southern of Ethiopia show increase in the of soil macrofauna between CA and CP. Greater population of termites, ants, millipedes, and centipedes due to residue retention and intercropping

Comparison of soil macrofauna developments under CA to the conventional practices in southern Ethiopia in 2015 main cropping season

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Mean number of Soil Macrofauna</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Termite</td>
</tr>
<tr>
<td>Maize and common bean intercropping-CP</td>
<td>0.67</td>
</tr>
<tr>
<td>Maize and common bean intercropping-CA</td>
<td>10.6</td>
</tr>
<tr>
<td>Maize and cowpea intercropping-CA</td>
<td>2.8</td>
</tr>
<tr>
<td>Sole maize-CA</td>
<td>0</td>
</tr>
<tr>
<td>Sole common bean-CA</td>
<td>7.9</td>
</tr>
<tr>
<td>Common bean maize rotation-CA</td>
<td>1.4</td>
</tr>
<tr>
<td>Percent of CA practice over CP</td>
<td>85.2</td>
</tr>
</tbody>
</table>
OBJECTIVE 3:
Increasing availability of varietal options
Participatory Variety Selection

- 170 maize PVS
- 172 legume PVS
- 53 forage PVS.
Seed growing partners and Quantities of seeds produced

**Maize:** Ethiopian SE, Regional SEs, Private SCs, farmer Coop Unions

**Legumes:** ESE, Private SCs, Unions

**Forage:** Research centers, farmers

<table>
<thead>
<tr>
<th>Crop</th>
<th>Breeder seed (ton)</th>
<th>Basic Seed (ton)</th>
<th>Certified Seed (ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>35.85</td>
<td>762.52</td>
<td>6606.195</td>
</tr>
<tr>
<td>Legume</td>
<td>204.47</td>
<td>1280.187</td>
<td>17583.04</td>
</tr>
<tr>
<td>Forage</td>
<td></td>
<td></td>
<td>26,476.1625</td>
</tr>
</tbody>
</table>

**Crop Breeder Seed:**
- Hybrid – Ethio Veg fru
- OPV – Meki-Batu Farmers’ Coop Union
Maize bean intercropping - Compatibility

• BH540 performed better when intercropped than when planted sole.

• The highest LER was obtained when BH540 was planted with Awash Melka Nasir gave the highest sole bean yield and second when intercropped.

• All the bean varieties can be recommended for intercropping with BH540 CRV.

• In Bako area BH546 and BH-547 found compatible for maize soya bean intercropping.
# Maize varieties identified for scaling out

## Maize

### Hybrids
- BH546
- BH661
- MH130
- BH547
- MH138Q
- MH140
- BH545

### OPV
- Melkasa2
- Gibe2

### Maturity, drought tolerance/stay green, yield, disease resistance, husk coverage, cob size

### Common beans:
- SER-125, SER-176, Hawasa Dume, Nasir, Awash 1 (Deme, Awash-2, Tatu, Wajo and Batu ), Remeda
- **Soya bean:**
  - Hawasa -04, Korme, AGS-7-1, TGX-13-3-26-44, Nyala, Godzilla (Nova and Belesa-95)
- **Ground nut:** Fetene
- **Cow Pea:** Bole
- **Mung bean:** Boreda and N26

### Common bean:
- seed color, maturity, marketability, seed size, pest resistance

### Soya bean:
- seed color, maturity, marketability, seed size, pest resistance

### Other:
- **Lupine:** Bora, Vitabor, Sanabor
- **Cowpea:** Acc.17216, Acc.12688, black eyepea, Kenkety
- **Lablab:** acc.1169
- **Grass:** Desho, Bracharia

### Shade tolerant,
- bio-mass, plant height, maturity, adaptability, dual purpose, ground cover
Objective 4.
Strengthening Regional and Local Innovations systems
## Scaling out approaches and reaches

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Demo plots</td>
<td>656</td>
<td>109</td>
<td>563</td>
<td>89</td>
</tr>
<tr>
<td>Innovation Platforms</td>
<td>75</td>
<td>30</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>Trainings</td>
<td>911</td>
<td>105</td>
<td>641</td>
<td>114</td>
</tr>
<tr>
<td>Field Days</td>
<td>13194</td>
<td>2424</td>
<td>1763</td>
<td>281</td>
</tr>
<tr>
<td>Exchange visits</td>
<td>1500</td>
<td>432</td>
<td>300</td>
<td>75</td>
</tr>
<tr>
<td>Media</td>
<td>57750</td>
<td>17250</td>
<td>38500</td>
<td>11500</td>
</tr>
</tbody>
</table>
## Scaling out partners

<table>
<thead>
<tr>
<th>Zone</th>
<th>Partners</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Gojjam</td>
<td>ARARI, Amara Seed enterprises, CIMMYT, Farmers cooperatives Union, Private seed suppliers, Mass Media Agencies (EBC, ATV)</td>
</tr>
<tr>
<td>East Wollega</td>
<td>BARC, Ormoia Seed Enterprise, Ethiopian Seed Enterprise enterprises, CIMMYT, Farmers cooperatives Union, Pvt seed suppliers, Mass Media Agencies (EBC, ORTV, )</td>
</tr>
<tr>
<td>West Shewa</td>
<td>BARC, Ormoia Seed Enterprise, Ethiopian Seed Enterprise enterprises, CIMMYT, Farmers cooperatives Union, Pvt seed suppliers, Mass Media Agencies (EBC, ORTV, )</td>
</tr>
<tr>
<td>East Shewa</td>
<td>EIAR, Seed enterprises, CIMMYT, Farmers cooperatives Union, Private seed suppliers, Mass Media Agencies (EBC, ORTV, )</td>
</tr>
<tr>
<td>West Arsi</td>
<td>EIAR, Seed enterprises, CIMMYT, Farmers cooperatives Union, Private seed suppliers, Mass Media Agencies (EBC, ORTV, )</td>
</tr>
<tr>
<td>Hadiya</td>
<td>WoGARC/Hawassa, South seed enterprise, Ethiopian Seed enterprise, Seed Enterprise, Farmers cooperatives Union, Pvt seed suppliers, Mass Media Agencies (EBC, STV, )</td>
</tr>
<tr>
<td>Sidama</td>
<td>SARI, South seed enterprise, Ethiopian Seed enterprise, Seed Enterprise, Farmers cooperatives Union, Pvt seed suppliers, Mass Media Agencies (EBC, STV, )</td>
</tr>
</tbody>
</table>
Training/Orientation for Front line agricultural experts, DAs and Demo host farmers
Maize and common bean intercropping in East Shewa zone, Dugda district, Sep 2017

Siraro maize demo July 17, 2017, field day Sep 2017
Improved common bean SER–119, SER–125 (Nasir), and Awash–2 (Awash-1) demonstration, East Shewa zone, Dugda district, 2017
Sole cropping and intercropping common bean and maize, West Arsi, Shalla, 2017
Field day participants discussion after field day West Arsi Zone, Shalla district, Sep 2017

Field day participants discussion after field day East Shewa Zone, ATJK, Sep 2017
East Shewa Zone deputy administrator giving appreciations and commitment to take the major responsibility on scaling out maize and common production, Dugda district, Sep 2017
Food preparations from maize and beans

TRAINING OF TRAINERS
Maize and bean foods
14 Recipes

Maize
1. Bullenta
2. Bread
3. Fosese
4. Cake
5. Kurkufa
6. Porridge

Bean
1. Asanbusa
2. Commonbean & Rice
3. Bogolli (mungbean)
4. Kiki
5. Nifro
6. Mungbean with Salad
7. Shiro
8. Soup
Extension materials
Leaflets- for farmers in Afan Oromo and Amharic
Use of Mass media

- More intensive used in 2017

- TV- EBC, STV, ESTV, OBN

- Radios- EBC (local FMs)

- Newspapers (Addis Zemen and Ethiopian Herald)
Print media

- Journal articles
- Guidelines
- Leaflets (in local language and English)
- Posters
5. Capacity Development

Human resource:
– Long term
  • 18 MSc & two PhD in local universities, 13 PhD students in Australia
  • 9 students supported for thesis work support
– Short term trainings (researchers, farmers and partners)
  • More than 297 researchers, partners and farmers trained on CA, IP, breeding techniques, modeling/APSIM, value chain analysis, PCVA, M&E, Gender mainstreaming, technical paper writings
  • Exposure visit to other countries by researchers, research management & partners (Kenya, Malawi and Australia)
  • Five researchers trained on CA by ARC for 15 days

• Facilities:
  – Vehicles (implementing centers), office supplies and facilities (Laptops, desk tops, GPS, Rain gages, pH meter, Cameras, soil moisture drier, analytical balance, cold room and irrigation facility maintenance, water pump
Challenges

- Supply sufficient seed of new varieties of maize and legumes
- Open grazing (makes reside retention difficult)
- Maize diseases (MLND)
- Fall armyworm
What is remaining issues

• Completing data analysis in indulging that of 2017 for the long term CA-based SI

• Producing publication- journals, proceedings and extension materials

• Producing extension/ communication materials

• Backstopping scaling out partners
Acknowledgments

• Australian government (ACIAR, AusAID)
• NARS-Management and researchers
• CIMMYT (program and objective coordinators)
• Scaling out partners
• Farmers & farmers union
• Team members across the research centres
Thank you for your interest!