Seeding the Green Future
Participatory breeding program for Securing Organic Cotton and Genetic Diversity
About OCA & FiBL

• The Organic Cotton Accelerator (OCA) is a multi-stakeholder initiative set up by a group of frontrunner organizations, focused on creating a prosperous organic cotton sector which benefits everyone - from farmer to consumer

• OCA seeks to improve the business case for both the organic cotton supply and demand side by prototyping and scaling solutions focused on for example better sourcing practices, quality servicing of farmers and increased supply chain integrity and traceability

• The Research Institute of Organic Agriculture (FiBL) is founded in 1973 as an independent nonprofit, focused on developing solutions to boost agricultural productivity while never losing sight of environmental, health and socio-economic impacts

• FiBL has extensive experience in and is committed to promoting and improving the organic (cotton) sector in India and beyond, through research, advisory work, training and capacity building
Seeding the Green Future

OCA represents the apparel industry’s major brands and key stakeholders. All committed to a viable organic cotton sector, with at its heart an improved business case for organic cotton farmers.

Quality non-GM cotton seed is an essential component of that farmer business case. Therefore, OCA decided to invest in FiBL’s ‘Seeding the Green Future’ to accelerate the process of identifying and developing organic cotton cultivars that perform well under organic growing conditions and in line with market demands.

Structure of the document

This document consists of three sections explaining the relevance of FiBL’s ‘Seeding the Green Future’ to the sector, the program approach and planning:

- **Introduction**: explains the relevance of and challenges faced by the organic seed breeding sector, and why OCA seeks to accelerate the FiBL program
- **Program goals & methodology**: presents the programs’ objectives and details of the program participatory approach to seed breeding
- **Timeline & roles**: states the next years’ activities, the governance structure, the long-term planning and desired outcomes
1. Introduction

Why we need to invest in organic cotton breeding in India
What does the fashion industry have to do with cotton plant breeding?

**Plant breeding**

Plant breeding is the process by which humans change the characteristics of plants over time to make them better crops, with traits that meet the needs of producers and the market. For organic cotton additional qualities are required/preferred.

**Important traits for organic cotton**

<table>
<thead>
<tr>
<th>Market</th>
<th>Producers</th>
<th>Organic standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Fiber quality, e.g.:</td>
<td>• Increased yield</td>
<td>• No genetic modification (non-GM/non-Bt)</td>
</tr>
<tr>
<td>– Staple length</td>
<td>• Increased tolerance of environmental pressures (e.g. drought, salinity)</td>
<td>• Good performance under organic growing conditions (low-input use)</td>
</tr>
<tr>
<td>– Fiber strength</td>
<td>• Pest and disease resistance</td>
<td></td>
</tr>
<tr>
<td>– Fiber fineness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Ginning outturn</td>
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</table>

Cotton breeding focuses on improving the above (organic) cotton qualities
The recent introduction of GM has radically changed the cotton species grown in India, affecting the organic (non-GM) seed market.

**Historic development of cotton species in India**

- India is leading global organic cotton producer (~70% of global production)
- Certified organic cotton only accounts for 1-2% of Indian production; GM cotton > 95%

<table>
<thead>
<tr>
<th>Cotton species</th>
<th>Legend</th>
<th>Share of cotton species grown in India**</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. hirsutum Upland</td>
<td>Hybrid</td>
<td>1947: Mainly native Indian species</td>
</tr>
<tr>
<td></td>
<td>Variety</td>
<td>1995: Strong growth hirsutum hybrids &amp; varieties</td>
</tr>
<tr>
<td>G. arboreum Desi</td>
<td></td>
<td>2000: Hirsutum dominates cotton market</td>
</tr>
<tr>
<td>G. herbaceum Desi</td>
<td></td>
<td>2012: Hirsutum hybrids have taken over</td>
</tr>
<tr>
<td>G. barbadense Pima/Egyptian</td>
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</tr>
</tbody>
</table>

**Introduction of GM cotton**

** Prof. Dr. R. W. Bharud, Agricultural University Rahuri, MA All Indian Cotton Improvement Project

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Present GM cotton dominance in India requires urgent collective action to make the organic cotton seeds market viable again

Impact of GM dominance

- Organic farmers and farmer programs struggle to find quality organic seed
- High dependency on global seed company holding Bt license

GM dominated sector

Limited investment in non-GM

Low performance non-GM seed

- Integrity risk throughout the chain due to increased GM contamination
- Small market to invest in
- More resilient traditional desi cotton disappearing
- Increasing yield gap with GM

Collective action required to break the vicious circle

| Increase investment in non-GM cotton breeding | Improve non-GM cotton performance and availability |
| Build capacity among sector stakeholders | Ensure integrity throughout the seed supply chain |
OCA recognizes the need for urgent non-competitive action and sees FiBL program in India as best practices to be promoted and scaled

### Principles of OCA

<table>
<thead>
<tr>
<th>OCA</th>
<th>FiBL program characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>As an accelerator, OCA seeks to <strong>promote best practices and scalable solutions</strong></td>
<td>FiBL has <strong>proven methodologies</strong> in organic cotton breeding and <strong>works with a scalable cluster approach</strong></td>
</tr>
<tr>
<td>OCA wants to support <strong>renowned partner organizations with track record</strong> in the respective field of practice</td>
<td>FiBL is a <strong>highly regarded scientific institute</strong> and has done <strong>multiple organic breeding related projects &amp; publications</strong></td>
</tr>
<tr>
<td>As a global initiative, with focus on India at start we look for <strong>internationally operating partners with good knowledge &amp; experience in India</strong></td>
<td>FiBL has <strong>cotton breeding experience in India</strong>, as well as numerous projects and initiatives in <strong>Europe, Asia, Latin America and Africa</strong></td>
</tr>
<tr>
<td>We believe in <strong>collaboration and participatory approaches</strong> involving all relevant stakeholders in the solution</td>
<td>FiBL works with a <strong>participatory approach</strong>, with all relevant actors and <strong>building local capacity</strong></td>
</tr>
</tbody>
</table>
FiBL has a strong track record in organic cotton breeding – with years of experience in improving the situation in India together with local partners.

**FiBL’s involvement in organic cotton seed breeding in India**

- **Partners & Donors**
- **Program: Participatory Cotton Cultivar Evaluation**
- **Involvement in Seed & Soil Task force**
  - Workshop *Disappearance of non-GM cotton*
  - Follow-up workshop *Disappearance of non-GM cotton*
- **Green Cotton Project: Cotton breeding & genetic diversity**
  - Organic Cotton Seed Summit

**Main results**

- Increased seed availability and diversity of cultivars
- Improved quality of arboreum cotton
- Capacity enhancement of farmers, research and extension staff
- Active participation by farmers

**Lessons learned moving forward**

- Fast breeding progress can be achieved through selection under organic conditions
- Organic can achieve similar yield as GM seeds
- Testing should be done for at least 3 years under representative organic conditions to make recommendations
- Involvement of higher Indian agricultural institutions is key to access genetic material
- Farmer adoption is key
2. Program goals & methodology

What are the aims of the ‘Seeding the Green Future’ program, and how will it achieve these?
With OCA support, FiBL can continue its work to improve accessibility and availability of high-quality seeds and integrity throughout the chain.

Objectives of ‘Seeding the Green Future’

- **Secure quality organic seed supply chain** for organic cotton farmers
- **Develop a portfolio of new cotton cultivars** with
  - Improved agronomic performance
  - High fiber quality (>28mm)
  - Adapted to the various local organic growing conditions
  - High resilience towards climate change
  - High adoption rate by farmers
- **Improve integrity of organic cotton at the source** by capacity building and close collaboration of actors among the supply chain
- **Contribute to improving farmer livelihoods**
The program approach brings together a diverse set of stakeholders to meet breeding and integrity objectives and increase scale.

Method

1. **Scale up participatory cotton breeding** by empowering farmers through collaboration with researchers, breeders, seed companies, advisors, textile industry

2. **Utilizing full potential of genetic cotton resources** in India
   - Explore desi (arboreum) potential for stress resistance and quality
   - Explore upland (hirsutum) cotton potential under organic conditions

3. **Training of trainers & farmers and implementation of**
   - Organic on-station and on-farm trials for cultivar testing and selection
   - Cross breeding and single plant selection
   - Maintenance breeding, seed multiplication, seed quality and GMO testing
Participatory organic cotton seed breeding is a long, complex and iterative process...

**Simplified overview of breeding process**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crossing</td>
<td>Parental lines are selected for their qualities and crossed to obtain a new plant with desired traits</td>
</tr>
<tr>
<td>Selecting</td>
<td>The new plant is grown in bulk, selecting most promising ones for testing under organic conditions</td>
</tr>
<tr>
<td>Testing</td>
<td>The selected plants are tested on desired qualities (yield, stress resistance, fiber quality, etc.)</td>
</tr>
<tr>
<td>Multiplication &amp; Release</td>
<td>Best performing seeds are selected, multiplied and approved before distribution</td>
</tr>
<tr>
<td>Distribution</td>
<td>Seeds are produced at scale and distributed to farmers for growing better organic cotton</td>
</tr>
</tbody>
</table>
...demanding seed breeders, farmer organizations and farmers to work closely together

Simplified overview of actors involved (cluster approach)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Crossing</th>
<th>Selecting</th>
<th>Testing</th>
<th>Multiplication &amp; Release</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Seed breeders (SB)</strong></td>
<td>provide parental lines and perform crossing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Farmer organization (FO)</strong></td>
<td>performs seed selection</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Trials are done on station, at <strong>farmer fields (FF)</strong> and with smaller collaborating FOs</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>The main cluster (SB &amp; FO) is responsible for multiplication and release</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>The primary FO distributes seed to farmers. Materials are owned by the main cluster</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
The breeding, seed multiplication and supporting activities are performed by a diverse set of actors working together

<table>
<thead>
<tr>
<th>Different actors</th>
<th>Main involvement</th>
</tr>
</thead>
</table>
| **Organic cotton farmer organizations** | • Participatory breeding and testing  
• Training farmers  
• Seed multiplication |
| **Public institutions & universities** | • Provide germplasm & crosses  
• On-station testing  
• Official release/truthfully labeled seeds |
| **Commercial seed companies** | • Provide non-GM seed on contract basis |
| **Others (NGOs/capacity builders/platforms)** | • Training the trainer/farmer  
• On-farm testing  
• Fundraising |
| **Coordinating research institute** | • Train the Trainers  
• Fundraising  
• Dissemination & lobby |

*Engagement recently started/ongoing*
3. Timeline & roles

What are the roles of all organizations involved? And what is the timeline for program development and delivery of results?
With the general partner agreement and first funding in place, the program is ready for 2017-18

**General agreement among partners and OCA support**

- Exchange of information and germplasm to serve spread among organic farmers
- Open project to include more farmer associations and breeders from India; further fund raising
  - Consortium mode of collaboration

**Activities in next cotton season (17-18)**

1. Evaluation of existing non-GM cotton germplasm for organic farming, incl. fiber quality
2. Testing and purification (free of GMO)
3. Crosses of non-GM desi and hirsutum germplasm
4. Capacity building on the level of organic associations
5. Farmers training & involvement in cultivar evaluation
6. On-station and on-farm trials to test existing cultivars / breeding lines
7. Fundraising
The different partners working together on the success of organic cotton breeding in India (2017-18), more partners will come.

Organogram
‘Seeding the Green Future’ has ambitious goals of scaling its output and impact, given that partners and funding increase.

Roadmap to scale – the ambitions

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Clusters &amp; FOs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 clusters</td>
<td>5 clusters</td>
<td>10 clusters</td>
</tr>
<tr>
<td>5 FOs</td>
<td>20 FOs</td>
<td>40 FOs</td>
</tr>
<tr>
<td>Regions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central India</td>
<td>Central and Southern India</td>
<td>Central, Southern and Northern India</td>
</tr>
<tr>
<td>New cotton lines</td>
<td></td>
<td></td>
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<tr>
<td>(takes &gt; 2 years)</td>
<td>10</td>
<td>30</td>
</tr>
</tbody>
</table>

Success factors to scale:

- Successful fundraising from donors, foundations, industry
- On-boarding critical partners: Indian Council for Agricultural Research (ICAR) and Central Institute for Cotton Research (CICR)
LET'S GROW THE FUTURE TOGETHER

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