National Workshop

Disappearing non-GM cotton – ways forward to maintain diversity, increase availability and ensure quality of non-GM cotton seed

Proceedings

University of Agricultural Sciences Dharwad (UASD)

Dharwad, Karnataka

21 June 2011

Edited by
Dionys Forster, Monika Messmer, Rajeev Baruah, Shreekant S. Patil

Organised by
Research Institute of Organic Agriculture (FiBL), Frick, Switzerland
bioRe India (Ltd), District Khargone, Madhya Pradesh, India
University of Agricultural Sciences Dharwad (UAS Dharwad), Dharwad, Karnataka, India

Supported by
Chetna Organic, Tarnaka, Hyderabad, India
Textile Exchange, Chennai, India
Content

1 Invitation

2 Presentation

2.1 Cotton Seed Development Strategies

2.2 CICR: Fostering linkages to support organic cotton programmes

2.3 Organic cotton markets and challenges

2.4 Ensuring organic cotton quality and certification today

2.5 Cotton quality requirements for the industry

2.6 Experienced challenges and solutions of Chetna

2.7 Experienced challenges and solutions of Pratibha Syntex

2.8 Experienced challenges and solutions of bioRe

2.9 bioRe - FiBL research activities

2.10 bioRe - Cotton screening (on-station, on-farm)

2.11 Cotton Seed Multiplication

2.12 Perspectives and outlook for India's non-GM cotton in future

3 Dharwad Declaration 21th June 2011

Annex

Annex 1: Programme

Annex 2: Participant List

Annex 3: Photographs

Annex 4: Press Coverage
1 Invitation

National Workshop on:

Disappearing non-GM cotton – ways forward to maintain diversity, increase availability and ensure quality of non-GM cotton seed

Synopsis
In the last years, India has become the largest organic cotton producer worldwide with an increasing number of organic cotton projects throughout the country. Conversely in 2010, more than 80% of India’s cotton area is grown with genetically modified Bt-cotton. Since the private and the public sector have withdrawn from the production of non-GM cotton seeds, the supply of non-GM seeds to the remaining 20% of farmers, including organic cotton projects, has become a critical. If no measures are taken to hold this process, the number of years for non-GM cotton seed production is counted. The absolute dominance of GM-cotton production will not only destroy India’s organic cotton sector, but will also reduce genetic diversity, which will affect the agro-ecosystem equilibrium in long term.

bioRe and FiBL invite to a two-day workshop on ways forward to maintain diversity, increase availability of appropriate cultivars and ensure high quality of non-GM cotton seed crucial for organic production. In more particular we would like to focus on the challenges of organic cotton seed provision. The workshop is expected to:
- provide overview on GM and non-GM cotton production in India;
- picture on-going non-GM seed production in India (available varieties, propagation organizations, seed distribution, breeding projects);
- highlight quality aspects and needs of non-GM (organic) cotton seed production;
- depict a roadmap to increase availability and ensure quality of non-GM cotton seed in future.

We are looking forward to interesting presentations and a constructive dialogue.

Support
The workshop is supported by the University of Agricultural Sciences Dharwad, bioRe India (Ltd), Research Institute of Organic Agriculture (FiBL), Switzerland, Chetna Organics and Cotton Exchange India.

Location and time
The workshop will be hold at the University of Agricultural Sciences Dharwad (UASD), Karnataka. It will take place from 21 to 22 June 2011.

Workshop organisation
- Research Institute of Organic Agriculture (FiBL), Dr. Dionys Forster, Ackerstrasse, CH-5070 Frick, Switzerland
- bioRe India (Ltd), Director Rajeev Baruah, 5th km Milestone, Kasravad Mandleshwar Road, Tehsil Kasravad, District Khargone – 451228, Madhya Pradesh, India
- University of Agricultural Sciences Dharwad (UAS Dharwad), Dr. S.S. Patil, Dharwad - 580 005, Karnataka, India
2 Presentation

2.1 Cotton Seed Development Strategies

Dr. A. Barik, Directorate of Cotton Development (DOCD), Government of India, Mumbai, Maharashtra

Seed Breeding Workshop
Dharwad 21st June 2011

Cotton Seed Development Strategies

Dr. Anupam Barik
Director, DOCD, Mumbai

Indian Agriculture

<table>
<thead>
<tr>
<th>Country</th>
<th>Population depend on Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>50.8%</td>
</tr>
<tr>
<td>China</td>
<td>38.5%</td>
</tr>
<tr>
<td>Brazil</td>
<td>6.4%</td>
</tr>
<tr>
<td>Argentina</td>
<td>3.7%</td>
</tr>
<tr>
<td>USA</td>
<td>0.9%</td>
</tr>
</tbody>
</table>
Indian Agriculture at a glance

- Land area: 2.4%
- Population: 17.7%
- Agri land: 57.0%
- Agri Population: 50.8%
- Agri land/person: 2.31 ha
- Irrigation: 35.8%

2017
- Gross area: 528.7 m ha
- Net sown area: 144.3 m ha
- Cropping intensity: 104%
- Work force: 58%
- Total GDP: 21%
- Total export: 11.1%
- Annual growth rate: 4.8%
- Engaged in farming: 60.4%
- Holding less than 1.0 ha: 55%
- NPK consumption: 122 kg/ha

Per capita availability in India
- Rice: 181 g/day
- Wheat: 154 gm/day
- Cereals: 64 gm/day
- Pulses: 37 gm/day
- Total food grain: 444 g/day
- Edible oil: 12.1 kg/year
- Cotton: 17.3 meters/year
- Manmade fibre: 111 meters/year

Indian Agriculture & Cotton

- Second largest kharif crop after rice
  - 6.8% of total sown area
  - 6.4 million cotton farmers
  - Average cotton area 1.5 ha
  - 65% dry land cotton
  - 85% hybrid cotton

in Global Textile
- Largest area
- 2nd largest producer, consumer & exporter
- 2nd largest producer of cotton yarn
- Largest exporter of cotton yarn
- Highest loom capacity
## Major crops of India

<table>
<thead>
<tr>
<th>Crops</th>
<th>Area (m. H.a)</th>
<th>Production (m. tonnes)</th>
<th>World share (%)</th>
<th>Yield (kg/ha)</th>
<th>Yield (World)</th>
<th>% Irrigated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>36.96</td>
<td>80.41</td>
<td>21.6</td>
<td>2177</td>
<td>4309</td>
<td>56.9</td>
</tr>
<tr>
<td>Wheat</td>
<td>28.52</td>
<td>80.72</td>
<td>11.4</td>
<td>2830</td>
<td>3086</td>
<td>90.9</td>
</tr>
<tr>
<td>Coarse Cereals</td>
<td>20.94</td>
<td>28.32</td>
<td></td>
<td>1348</td>
<td></td>
<td>14.2</td>
</tr>
<tr>
<td>Pulses</td>
<td>23.35</td>
<td>14.60</td>
<td>25.10</td>
<td>625</td>
<td>1850</td>
<td>16.2</td>
</tr>
<tr>
<td>Oilseeds</td>
<td>26.11</td>
<td>24.93</td>
<td>19.21</td>
<td>955</td>
<td>1554</td>
<td>27</td>
</tr>
<tr>
<td>Cotton</td>
<td>11.00</td>
<td>33.50</td>
<td>16.50</td>
<td>518</td>
<td>765</td>
<td>35</td>
</tr>
<tr>
<td>Jute</td>
<td>0.92</td>
<td>11.29</td>
<td>63.30</td>
<td>2216</td>
<td>2800</td>
<td>nil</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>4.86</td>
<td>324.31</td>
<td>29.00</td>
<td>66922</td>
<td>71510</td>
<td>93.5</td>
</tr>
<tr>
<td>All India</td>
<td>141.00</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## MSP & Economics of Major crops

<table>
<thead>
<tr>
<th>Crops</th>
<th>MSP (Rs. / qtl)</th>
<th>Cost of cultivation (Rs/ha)</th>
<th>Production Cost (Rs/qtl)</th>
<th>Net profit Rs./ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>1000 to 1030</td>
<td>18000-22000</td>
<td>550-700</td>
<td>20-25000</td>
</tr>
<tr>
<td>Wheat</td>
<td>1100</td>
<td>15000-18000</td>
<td>650-850</td>
<td>22-30000</td>
</tr>
<tr>
<td>Coarse Cereals</td>
<td>880-965</td>
<td>10000-12000</td>
<td>600-700</td>
<td>8-10000</td>
</tr>
<tr>
<td>Pulses</td>
<td>3000-3500</td>
<td>8000-10000</td>
<td>1600-2200</td>
<td>12-15000</td>
</tr>
<tr>
<td>Oilseeds</td>
<td>2000-2500</td>
<td>9000-12000</td>
<td>1200-1500</td>
<td>15-20000</td>
</tr>
<tr>
<td>Cotton</td>
<td>2500-3000</td>
<td>20000-25000</td>
<td>1500-2000</td>
<td>30-50000</td>
</tr>
<tr>
<td>Jute</td>
<td>16000-20000</td>
<td>10000-11000</td>
<td>20-25000</td>
<td></td>
</tr>
<tr>
<td>Sugarcane</td>
<td>139.12</td>
<td>40000-50000</td>
<td>75-100</td>
<td>25-35000</td>
</tr>
</tbody>
</table>
## Price realization of Cotton cultivation

<table>
<thead>
<tr>
<th>Commodities</th>
<th>Price hike (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/09/10 to 12/10/2010</td>
<td></td>
</tr>
<tr>
<td>Cotton</td>
<td>140</td>
</tr>
<tr>
<td>Wool</td>
<td>40</td>
</tr>
<tr>
<td>Linen</td>
<td>38</td>
</tr>
<tr>
<td>Silk</td>
<td>100</td>
</tr>
<tr>
<td>MMF</td>
<td>30-35</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Month</th>
<th>Price realization (US cents per lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov 03</td>
<td>76.77</td>
</tr>
<tr>
<td>March 08</td>
<td>81.54</td>
</tr>
<tr>
<td>March 09</td>
<td>51.50</td>
</tr>
<tr>
<td>Aug 2010</td>
<td>90.35</td>
</tr>
<tr>
<td>Feb 2011</td>
<td>216.90</td>
</tr>
</tbody>
</table>

## APY of Cotton in India

<table>
<thead>
<tr>
<th>Year</th>
<th>Area</th>
<th>DES</th>
<th>CAB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Production</td>
<td>Yield</td>
</tr>
<tr>
<td>2000-01</td>
<td>85.3</td>
<td>95.2</td>
<td>190</td>
</tr>
<tr>
<td>2001-02</td>
<td>91.0</td>
<td>100.0</td>
<td>186</td>
</tr>
<tr>
<td>2002-03</td>
<td>76.7</td>
<td>96.2</td>
<td>191</td>
</tr>
<tr>
<td>2003-04</td>
<td>76.0</td>
<td>137.3</td>
<td>307</td>
</tr>
<tr>
<td>2004-05</td>
<td>89.7</td>
<td>164.3</td>
<td>318</td>
</tr>
<tr>
<td>2005-06</td>
<td>86.8</td>
<td>185.0</td>
<td>362</td>
</tr>
<tr>
<td>2006-07</td>
<td>91.4</td>
<td>226.3</td>
<td>421</td>
</tr>
<tr>
<td>2007-08</td>
<td>94.3</td>
<td>258.8</td>
<td>467</td>
</tr>
<tr>
<td>2008-09</td>
<td>93.7</td>
<td>231.6</td>
<td>419</td>
</tr>
<tr>
<td>2009-10</td>
<td>103.20</td>
<td>239.35</td>
<td>393</td>
</tr>
<tr>
<td>2010-11</td>
<td>111.50</td>
<td>339.00</td>
<td>518</td>
</tr>
<tr>
<td>2011-12</td>
<td>115.00</td>
<td>355.00</td>
<td>540</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Area</th>
<th>Prod. Lakh bales</th>
<th>Yield: kg lint/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010-11</td>
<td>111.50</td>
<td>339.00</td>
<td>518</td>
</tr>
<tr>
<td>2011-12</td>
<td>115.00</td>
<td>355.00</td>
<td>540</td>
</tr>
</tbody>
</table>

Sowing done so far 22.00 lakh ha (2011-12)
### State wise Annual Growth Rate (2000-2009)

<table>
<thead>
<tr>
<th>States</th>
<th>Area</th>
<th>Production</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haryana</td>
<td>-3.95</td>
<td>12.54</td>
<td>17.15</td>
</tr>
<tr>
<td>Punjab</td>
<td>-1.75</td>
<td>7.23</td>
<td>8.35</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>-6.34</td>
<td>12.60</td>
<td>20.14</td>
</tr>
<tr>
<td>Gujarat</td>
<td>3.78</td>
<td>20.59</td>
<td>16.24</td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>1.79</td>
<td>10.18</td>
<td>8.14</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>0.14</td>
<td>7.90</td>
<td>7.85</td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>3.04</td>
<td>8.37</td>
<td>5.25</td>
</tr>
<tr>
<td>Karnataka</td>
<td>-4.86</td>
<td>5.11</td>
<td>10.46</td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>-6.59</td>
<td>-6.70</td>
<td>0.98</td>
</tr>
<tr>
<td>Orissa</td>
<td>-1.03</td>
<td>13.07</td>
<td>5.32</td>
</tr>
<tr>
<td>UP &amp; Others</td>
<td>22.83</td>
<td>25.10</td>
<td>-3.40</td>
</tr>
<tr>
<td>All India</td>
<td>0.37</td>
<td>11.07</td>
<td>10.85</td>
</tr>
</tbody>
</table>

### Global Bio-Tech crop coverage (2010)
- 29 countries adopted bio tech crops
- Global bio tech crop size 148 million ha
- Top eight countries

<table>
<thead>
<tr>
<th>Countries</th>
<th>Biotech area (M.ha)</th>
<th>Major Crops</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>66.8</td>
<td>Maize, Cotton, Squash, Papaya, Potato, Sugar beet, Soyabean, Alfalfa</td>
</tr>
<tr>
<td>Argentina</td>
<td>22.9</td>
<td>Soyabean, Cotton, Maize</td>
</tr>
<tr>
<td>Brazil</td>
<td>25.4</td>
<td>Soyabean, Cotton Maize</td>
</tr>
<tr>
<td>India</td>
<td>9.4</td>
<td>Cotton</td>
</tr>
<tr>
<td>Canada</td>
<td>8.8</td>
<td>Canola, Sugarbeet, Maize, Soyabean</td>
</tr>
<tr>
<td>China</td>
<td>3.5</td>
<td>Cotton, Sweet pepper, Tomato, Papaya</td>
</tr>
<tr>
<td>Paraguay</td>
<td>2.6</td>
<td>Soyabean</td>
</tr>
<tr>
<td>S. Africa</td>
<td>2.2</td>
<td>Soyabean, Cotton Maize</td>
</tr>
<tr>
<td>Global</td>
<td>148.00</td>
<td></td>
</tr>
</tbody>
</table>
Bt cotton area (lakh ha) in India

<table>
<thead>
<tr>
<th>Year</th>
<th>Total area</th>
<th>Bt area</th>
<th>% of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002-03</td>
<td>73.90</td>
<td>0.29</td>
<td>0.39</td>
</tr>
<tr>
<td>2003-04</td>
<td>78.35</td>
<td>0.93</td>
<td>1.18</td>
</tr>
<tr>
<td>2004-05</td>
<td>89.70</td>
<td>4.98</td>
<td>5.55</td>
</tr>
<tr>
<td>2005-06</td>
<td>88.73</td>
<td>10.14</td>
<td>11.42</td>
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<td>2005-07</td>
<td>91.58</td>
<td>34.61</td>
<td>37.79</td>
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<td>2007-00</td>
<td>95.06</td>
<td>63.34</td>
<td>66.0</td>
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<tr>
<td>2008-09</td>
<td>93.73</td>
<td>69.00</td>
<td>73.0</td>
</tr>
<tr>
<td>2009-10</td>
<td>99.85</td>
<td>79.82</td>
<td>79.93</td>
</tr>
<tr>
<td>2010-11</td>
<td>111.50</td>
<td>98.00</td>
<td>87.64</td>
</tr>
<tr>
<td>2011-12</td>
<td>115.00</td>
<td>105.00</td>
<td>91</td>
</tr>
</tbody>
</table>

Source: State Dept of Agril

Immediate Issues on Bt cotton

1340 Bt hybrids need recommendations
Under the TMC-MM-1 programme, Bt resistant hybrids are identified and the list is disseminated through TMC-MM-II

New Emerging pests & diseases
Mealybugs, mirid bugs, thrips, Spodoptera, gall midges, Peligra capensis, CLCuV, grey mildew and tobacco leaf streak virus. The management practices are spread through TMC-MM-II

Leaf Reddening
Hybrids have low harvest index: More vegetation, More fertilizer and pesticide requirements. High soil nutrient depletion. Wilt & leaf reddening are now severe in rained tracts. Strategies are disseminated through TMC-MM-II

No refugia compliance
50% Area under Bt-cotton, high risk of bollworm resistance development (8 to 32-fold R now). Bt-RM strategies for H. armigera and PBW have been devised

Jassid Resistance to Gaucho
All seeds are treated & cross is also sprayed with imidacloprid (50 to 6450-fold R in 75% populations tested). Eco-friendly management strategies are disseminated through TMC-MM-II
ELS cotton in India

- World ELS area 6.50 lakh ha
- World ELS Production 30.00 lakh bales
- Requirement in India 20 lakh bales by 2015
- Present availability in India 4-5 lakh bales

- Golden era of ELS (1983-84 to 1989-90)
  - 11.46 lakh bales ELS
  - 12.21 lakh bales DCH 32 (1981 release), TCHB 213, DHB 105
  - 0.44 lakh bales Suvin (1974 release)
- Private sector Bt hybrids, RCHB 702 Bt, RCHB 708 Bt, MRC 6918 Bt (2008-09)

Constraints of ELS

- Low productivity (4-5 qtls/acre in Suvin; 7-8 qtls/acre in DCH 32)
- Long duration
- Lack of awareness & Bt genotype
- High production cost
- Shortage & high cost of labour
- Lack of incentive based marketing support
Constraints & Suggestions to boost desi cotton

<table>
<thead>
<tr>
<th>Production Constraints</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low yield with poor quality fibre</td>
<td>Long linted desi hybrids equal to <em>hirsutum</em> developed and need promotion in identified zones</td>
</tr>
<tr>
<td>Non availability of sufficient quantity seeds</td>
<td>Target oriented seed production programme by SSC, NSC, SAUs &amp; ICAR</td>
</tr>
<tr>
<td>Rainfed &amp; grown on marginal soils</td>
<td>Creating life saving irrigation &amp; improving soil health</td>
</tr>
<tr>
<td>No special promotional activities</td>
<td>Special thrust &amp; focus based programme at State &amp; Central level and implementing the same through PPP mode</td>
</tr>
<tr>
<td>Non availability of Bt version</td>
<td>No desi cotton Bt variety/ hybrids so far</td>
</tr>
<tr>
<td>Better management practices</td>
<td>Intercropping, close spacing, low cost drip, farm pond</td>
</tr>
<tr>
<td>Long duration</td>
<td>Short duration variety suitable for double cropping</td>
</tr>
<tr>
<td>Lack of stable market</td>
<td>Offering attractive package in marketing of desi cotton</td>
</tr>
</tbody>
</table>

National Fibre policy

- **Future outlook**

<table>
<thead>
<tr>
<th>Year</th>
<th>Production</th>
<th>Consumption</th>
<th>Surplus</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010-11</td>
<td>319</td>
<td>267</td>
<td>52</td>
</tr>
<tr>
<td>2014-15</td>
<td>384</td>
<td>323</td>
<td>61</td>
</tr>
<tr>
<td>2019-20</td>
<td>483</td>
<td>413</td>
<td>70</td>
</tr>
</tbody>
</table>

- **Organic cotton**

  World's largest producer

<table>
<thead>
<tr>
<th>Year</th>
<th>Area (lakh ha)</th>
<th>Production (Lakh bales)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008-09</td>
<td>2.00</td>
<td>5.00</td>
</tr>
<tr>
<td>2014-15</td>
<td>5.00</td>
<td>12.50</td>
</tr>
</tbody>
</table>

Suvin Cotton

- 1989-90: 36000 bales
- 2008-09: 1250 bales

Suggested for separate Masters
Global Organic cotton Status

- 22 countries are involved
- India, Turkey & Syria (87% production)
- Global area 1.61 lakh ha
- Production 6.68 lakh bales
- Area & Production increasing at faster rate
- From 2008 India ranks first in organic cotton production
- Syria, Turkey, China, Tanzania, United States, Uganda, Peru, Egypt and Burkina Faso

State wise Organic Cotton area & Production during 2008-09 in India
(Source APEDA)

<table>
<thead>
<tr>
<th>States</th>
<th>Organic Prodn (MT)</th>
<th>Organic Area (ha)</th>
<th>In Conversion Prodn (MT)</th>
<th>In Conversion Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP</td>
<td>732</td>
<td>789</td>
<td>1504</td>
<td>2595</td>
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<tr>
<td>Delhi</td>
<td>0</td>
<td>0</td>
<td>1449</td>
<td>1073</td>
</tr>
<tr>
<td>Gujarat</td>
<td>6411</td>
<td>5059</td>
<td>10650</td>
<td>7959</td>
</tr>
<tr>
<td>Haryana</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Karnataka</td>
<td>100</td>
<td>131</td>
<td>196</td>
<td>365</td>
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<tr>
<td>MP</td>
<td>106622</td>
<td>74964</td>
<td>27189</td>
<td>23060</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>37958</td>
<td>16557</td>
<td>15829</td>
<td>23093</td>
</tr>
<tr>
<td>Orissa</td>
<td>34425</td>
<td>30341</td>
<td>6375</td>
<td>5984</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>0</td>
<td>0</td>
<td>3283</td>
<td>6333</td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>674</td>
<td>914</td>
<td>299</td>
<td>367</td>
</tr>
<tr>
<td>Total</td>
<td>186925</td>
<td>128769</td>
<td>66758</td>
<td>70838</td>
</tr>
<tr>
<td>Equal to (Lakh bales)</td>
<td>3.62</td>
<td>1.28</td>
<td>1.30</td>
<td>0.70</td>
</tr>
</tbody>
</table>
Major challenges in organic cotton sector

- **Gap in Research support**
  (recently started at UAS, Dharwad & TNAU, Coimbatore)
- **Poor availability of non-GM untreated seed**
  (private seed company to be tied up)
- **Production of organic matter**
  (vermicompost beneficiaries to be associated)
- **High cost of certification**
- **Lack of standard package & practices**
  (two years study going on)

- **Long conversion period**
- **Lack of organic market**
- **Inadequate organic dyeing procedures**
- **Lack of inter-departmental coordination**
- **Lack of information, knowhow & skills**
- **Reasonable Price premium structure**

Policy Initiatives in Seed Sector

- **Enactment of the Seed Act -1966**
- **Seed Review Team - 1968**
- **Seed Control Order – 1983**
- **ISOPOM-1986**
- **Production & Distribution Subsidy**
- **Distribution of Seed Mini kits**
- **National Seed Policy- 2002**
- **The Seed Bill 2004**
- **National Seed Plan -2005**
- **National Food Security Mission -2007**
- **Rastriya Krishi Vikas Yojana-2007**
# Seed Divisions Central Sector Schemes

| Assistance for boosting seed production in the Private sector (25% cost limited to Rs.25 lakhs) |
| Seed Village Scheme (50% cost for production of certified seeds) |
| Transport subsidy on Movement of Seeds (North Eastern states only) |
| Establishment & Maintenance of Seed Bank (For NSC & SFCI and SSC) |
| Quality Control arrangements on Seeds (Strengthening Quality Testing Organisations) |
| Human Resource Development (Training of officials) |
| Boosting seed export |
| Promoting Hybrid rice seeds (Rs.20-25/kg seed) |
| Use of Bio Technology in Agriculture (Training, Bt seed testing etc) |
| Crop Specific Schemes (TMC, JTM, NFSM, ISOPOM, State Work Plan) |

---

## Salient Features

**Seed Bill 2004**
- Evaluation of Performances
- Compensation to the farmers
- Registration of seed producers & processing units
- Seed Dealers to be registered
- Seed analysis & seed testing
- Regulation of sale of seed & certification
- Export & Import
- Offences & punishment

**National seed Policy-2002**
- Varietal development
- Plant variety protection
- Seed production
- Quality assurance
- Seed distribution & Marketing
- Infrastructure Development
- Transgenic plant variety
- Import of seeds & planting materials
- Seed Export
- Promotion of Private seed sector
- Strengthening of monitoring system
Crop wise certified seed distribution

<table>
<thead>
<tr>
<th>Crops</th>
<th>Quantity in Lakh qtls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1991-92</td>
</tr>
<tr>
<td>Cereals</td>
<td>35.35</td>
</tr>
<tr>
<td>Pulses</td>
<td>3.29</td>
</tr>
<tr>
<td>Oilseeds</td>
<td>9.66</td>
</tr>
<tr>
<td>Cotton</td>
<td>1.77</td>
</tr>
<tr>
<td>Others</td>
<td>7.17</td>
</tr>
<tr>
<td>All India</td>
<td>57.50</td>
</tr>
</tbody>
</table>

Present Perception Of Indian Agriculture

Presently Cotton sector is interfering with FOOD SECURITY OF THE COUNTRY

The IMC mode approach is going to be dropped in 12 Plan period

Assuming that farmers are now self sufficient to harvest a good crop

Annual outlay on cotton reduced substantially

National Food Security Mission (NFPM)

Extending green revolution to Eastern India

Nutritional Security through Intensive Millets Promotion (INSIMP)

Agricultural Infrastructure development

Improving soil health & Environment

Increasing irrigation potentiality through water harvesting method & micro irrigation

Tackling Global warming in Agriculture
Desirable output of Future cotton

- Restricting increase of cotton area
- Marching towards cotton mechanization
- Drip & fertigation on large scale
- Public sector Bt variety/hybrids under deshi & ELS group
- Special thrust on Organic cotton Research & Development
- More awareness about quality procurement mechanism
- Crop Insurance & stable MSP as per species
- APMC oriented procurement mechanism
- Increase in domestic consumption & value added textile product
- Commercialization of cotton by product use such as cotton stalk, seed oil, cake, linter etc.
2.2 CICR: Fostering linkages to support organic cotton programmes

Dr. M. V. Venugopalan, Central Institute for Cotton Research (CICR), Nagpur, Maharashtra

CICR: fostering linkages to support organic cotton programmes

MV Venugopalan
Principal Scientist, CICR, Nagpur

CURRENT STATUS OF ORGANIC COTTON-CICRs perception

- Small holder farming systems - economic priorities over social and environmental benefits.
- No guaranteed premium price for farmers today.
- Researchers must play a more pro-active role promoting organic cotton.
- Risk of over-supply.
- Limited diversification opportunities – other crops, value addition, better demand, supply management.
- Difficulty in obtaining of GM seeds.
- Fear of contamination by GM cotton and difficulty in detection of contamination
### Genetically Modified Cotton: Events

<table>
<thead>
<tr>
<th>Event</th>
<th>Trade name</th>
<th>Company</th>
<th>Trait</th>
<th>Insert</th>
<th>Marker</th>
</tr>
</thead>
<tbody>
<tr>
<td>MON15988</td>
<td>Bellgard R</td>
<td>Monsanto</td>
<td>Insert Resistant</td>
<td>Cry2Ab</td>
<td>Cry1F + pyrA</td>
</tr>
<tr>
<td>MON 931</td>
<td>Bellgard</td>
<td>Monsanto</td>
<td>Insert Resistant</td>
<td>Full length Cry1Ac</td>
<td></td>
</tr>
<tr>
<td>GFM-Cry1A</td>
<td>Fecon-B</td>
<td>C&amp;H, China</td>
<td>Insert Resistant</td>
<td>Truncated Cry1Ac</td>
<td></td>
</tr>
<tr>
<td>Event-1</td>
<td>JK-50</td>
<td>JK Seeds</td>
<td>Insert Resistant</td>
<td>Truncated Cry1Ac</td>
<td></td>
</tr>
<tr>
<td>BN-BS-LAC1</td>
<td>BN-87</td>
<td>UAS &amp; IAC</td>
<td>Insert Resistant</td>
<td>Truncated Cry1Ac</td>
<td></td>
</tr>
<tr>
<td>MII5124</td>
<td>-</td>
<td>Masfalis</td>
<td>Insert Resistant</td>
<td>Cry1C</td>
<td>pyrA</td>
</tr>
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</table>

#### Events approved worldwide:

<table>
<thead>
<tr>
<th>Event</th>
<th>Trade name</th>
<th>Company</th>
<th>Trait</th>
<th>Insert</th>
<th>Marker</th>
</tr>
</thead>
<tbody>
<tr>
<td>9807-31868</td>
<td>-</td>
<td>Calgene Inc.</td>
<td>Insert Resistant</td>
<td>Cry1Ac</td>
<td>pyrA</td>
</tr>
<tr>
<td>BXX</td>
<td>BXX Cotton</td>
<td>Calgene Inc.</td>
<td>Herbicide tolerance</td>
<td>bar gene</td>
<td>pyrA</td>
</tr>
<tr>
<td>MON 14059</td>
<td>Roundup Ready</td>
<td>Monsanto</td>
<td>Herbicide tolerance</td>
<td>EPSPS</td>
<td>pyrA</td>
</tr>
<tr>
<td>MON 757/1076</td>
<td>Bellgard</td>
<td>Monsanto</td>
<td>Insert Resistant</td>
<td>Cry1Ac</td>
<td>pyrA</td>
</tr>
<tr>
<td>2011-24-226</td>
<td>DOX</td>
<td>Monsanto</td>
<td>Insert Resistant</td>
<td>Cry1F</td>
<td>pat.</td>
</tr>
<tr>
<td>2011-236x2006-210-23</td>
<td>WideStrike</td>
<td>DOX &amp; Pioneer</td>
<td>Herbicide tolerance</td>
<td>EPSPS</td>
<td>pyrA</td>
</tr>
<tr>
<td>MON8913</td>
<td>Roundup Ready Flex</td>
<td>DOX &amp; Pioneer</td>
<td>Herbicide tolerance</td>
<td>EPSPS</td>
<td>pyrA</td>
</tr>
<tr>
<td>2009-210-23</td>
<td>Liberty Link cotton</td>
<td>Bayer &amp; Aventis</td>
<td>Herbicide tolerant</td>
<td>bar phosphinothricin N-acetyltransferase</td>
<td></td>
</tr>
<tr>
<td>LL-Cotton 25</td>
<td>Liberty Link cotton</td>
<td>Bayer &amp; Aventis</td>
<td>Herbicide tolerant</td>
<td>bar phosphinothricin N-acetyltransferase</td>
<td></td>
</tr>
<tr>
<td>JMT-412</td>
<td>VipGen</td>
<td>Syngenta</td>
<td>Insert Resistant</td>
<td>Vip2A</td>
<td>pyrA</td>
</tr>
</tbody>
</table>

### Pyramiding genes – makes detection for GM more challenging

**Insect resistance + herbicide tolerance + drought tolerance + superior fibre + higher adaptability + ???**
Products/services and support from CICR (ICAR)

- Testing for non-GMO seeds and assistance in setting up testing facilities to detect GM cotton
- Assist promotion of organic *G. arboreum* cotton - to minimize GM contamination
- Organic seed production based on a prior demand and support to seed production in organic farms
- Biophysical and socio-economic sustainability assessment of organic production systems - partnership mode
- Consultancy/ advisory and R&D back including development and testing of organic product - mealy kill and mealy quit, microbial consortium etc.
- Training in organic cotton production technology and in detection of GMO in organic cotton.
Development of long linted *G. arboreum* by public sector

<table>
<thead>
<tr>
<th>S.N</th>
<th>Genotype</th>
<th>2.5% SL (mm)</th>
<th>MIC</th>
<th>Strength (g/parcel)</th>
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<tbody>
<tr>
<td>1</td>
<td>CINA 344</td>
<td>28.2</td>
<td>4.6</td>
<td>20.1</td>
</tr>
<tr>
<td>2</td>
<td>PAIG 8/1</td>
<td>28.1</td>
<td>5.3</td>
<td>22.5</td>
</tr>
<tr>
<td>3</td>
<td>CINA 316</td>
<td>27.6</td>
<td>4.8</td>
<td>21.3</td>
</tr>
<tr>
<td>4</td>
<td>MDL 2463</td>
<td>27.4</td>
<td>4.6</td>
<td>23.6</td>
</tr>
<tr>
<td>5</td>
<td>AKA 9503</td>
<td>27.1</td>
<td>4.4</td>
<td>23.2</td>
</tr>
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<td>6</td>
<td>KWA 140</td>
<td>27</td>
<td>5.1</td>
<td>23.5</td>
</tr>
<tr>
<td>7</td>
<td>DLSa 56</td>
<td>27</td>
<td>4.9</td>
<td>22.8</td>
</tr>
<tr>
<td>8</td>
<td>PA 402</td>
<td>26.9</td>
<td>4.2</td>
<td>22.6</td>
</tr>
<tr>
<td>9</td>
<td>CINA 318</td>
<td>26.6</td>
<td>5.9</td>
<td>22.8</td>
</tr>
<tr>
<td>10</td>
<td>KWA 225</td>
<td>26.5</td>
<td>5.3</td>
<td>22</td>
</tr>
<tr>
<td>11</td>
<td>MDL 2607</td>
<td>26.4</td>
<td>5</td>
<td>22</td>
</tr>
<tr>
<td>12</td>
<td>AKA 9136</td>
<td>26.3</td>
<td>5.4</td>
<td>22.6</td>
</tr>
<tr>
<td>13</td>
<td>IAS 2</td>
<td>26</td>
<td>4.4</td>
<td>21.2</td>
</tr>
<tr>
<td></td>
<td>PA 255 (Check)</td>
<td>25.4</td>
<td>4.5</td>
<td>20.1</td>
</tr>
<tr>
<td>14</td>
<td>GAM93</td>
<td>24.6</td>
<td>4.6</td>
<td>20</td>
</tr>
<tr>
<td>15</td>
<td>AKA 8</td>
<td>23.7</td>
<td>5.4</td>
<td>21.4</td>
</tr>
</tbody>
</table>

**CICRs expectations**

- A consolidated seed indent before the sowing season
- Current organic cotton growing package in different areas
- Training requirement—nature and duration and number of participants (consolidated)
- Researchable issues where CICRs intervention is needed
- Feedback on the performance of varieties developed by public sector in organic farms
THANK YOU
2.3 Organic cotton markets and challenges

Ms P. Nagarajan, Regional Director Textile Exchange, Chennai, Tamil Nadu

ORGANIC COTTON MARKETS AND CHALLENGES

DISAPPEARING NON GMO SEEDS.
U.A.S DHARWAD, 21ST JUN 2011

PRABHA NAGARAJAN
REGIONAL DIRECTOR ,INDIA
TEXTILE EXCHANGE
prabha@textileexchange.org,ranhansau@gmail.com
91 44 26293585
9840385644

Textile Exchange....who we are

Textile Exchange: Creating a Healthier Future through Organic Fiber and Sustainable Textiles.....

Formerly known as ORGANIC EXCHANGE , from inception in 2002 until October 2010.

A nonprofit organization with staff in eight countries committed to expanding global organic fiber agriculture, using organic cotton as the original catalyst.
WHY COTTON?

Improving organic cotton production addresses key environmental issues impacting cotton. Facilitates discussions about agricultural issues worldwide including:

- biodiversity,
- food security,
- poverty alleviation,
- strengthening rural communities
- water quality and utilization, soil protection, and climate change impacts.

OUR APPROACH ...

- Textile Exchange brings together brands, retailers, supply chain partners, farmers, and other key stakeholders to learn about the social and environmental benefits of organic agriculture and develop new business models and tools that support greater use of organic fibers and sustainable textiles.
Since 2002 we have helped...

- Grow the global organic cotton market ...
- Make the business case for implementing an organic fiber program as part of a larger strategy that aligns business and environmental decisions.
- Educate stakeholders about certified organic fibers so consumers can reap the benefits of the beauty, comfort, and performance of products, while minimizing harm to people and the planet.
- Work with sourcing groups, executive management, marketing teams, supply chain partners, or new vendors to implement a successful organic cotton program.
- Keep members and industry partners up-to-date on issues that affect the organic fiber market, as this global market segment continues to evolve.

WHO IS IN THE MARKET?

- Some of the world’s largest brands and retailers...
- Small niche brands
- Individual designers and fashion gurus.
- Industry specific sourcing groups.
Major brands in the market place....

1. C&A
2. Nike
3. Walmart / Sam's Club
4. Williams - Sonoma (Pottery Barn)
5. H&M
6. Anvil
7. Co Op, Switzerland
8. Greenhouse
9. Levi Strauss
10. Target
11. Adidas
12. Nordstrom

Several brands have committed organic lines of garments.
Some other leading Brands ....

Marks & Spencer, Gap, New Look and Timberland.

Smaller ethical fashion names such as People Tree, Howies, and Green Baby.

Specialist retailers such as Greenfibres and Seasalt.

Why People bought Organic...

Top ten reasons

- Naturainess/unprocessed 40%
- Restricted use of pesticides 34%
- Better taste 30%
- Better for my well-being 28%
- Better for the planet 25%
- More care in farming 24%
- Kind to animals 22%
- GM free 18%
- Encourages wildlife 16%
- Helping climate change 12%
Recession and Organic cotton markets

While the recession had a significant impact on the overall economy, nonetheless substantial growth in the use of organic cotton on the part of several of the Top Twelve companies.

This was particularly the case with C&A and Nike.

Brands such as Adidas, Anvil Knitwear, H&M, and Williams-Sonoma also registered good growth in 2009 over 2008.

Sales have remained the strongest when companies have figured out their supply chain, customers, and product mix.

Innovative manufacturers and retailers around the world initiated or dramatically expanded organic cotton programs.

Why markets remained strong?

In a down economy, why would brands and retailers increase their use of organic cotton and other fibers considered more environmentally preferable?

They found that the world has changed and it now makes more sense for the bottom line to adopt programs based in the three tenets of sustainability – Economy, Environment, and Social Support.
So what do we see?

- A significant increase in textile product transparency, tracking and tracing of raw materials, environmentally-preferred processing practices, an ongoing worldwide effort to improve fair labor practices, reduced energy and water use, and other positive developments.

What kind of Products?
Major Regions Producing Organic Cotton

**United States of America**
- Texas
- New Mexico
- California

**Latin America**
- Peru
- Paraguay
- Brazil
- Argentina*
- Nicaragua

**Africa**
- Benin
- Burkina Faso
- Mali
- Senegal
- South Africa
- Zambia
- Tanzania
- Uganda

**Europe, Middle East & North Africa**
- Israel
- Egypt
- Greece
- Kyrgyzstan
- Syria
- Tajikistan
- Turkey

**China**
- Xinjiang District

**South East Asia**
- Pakistan
- India
- Madhya Pradesh
- Maharashtra
- Gujarat
- Orissa
- Karnataka
- Tamil Nadu
- Andhra Pradesh
- Rajasthan
## Global Production Figures, 09/10

<table>
<thead>
<tr>
<th>Country</th>
<th>MTs UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>195,000.83</td>
</tr>
<tr>
<td>Syria</td>
<td>20,000.00</td>
</tr>
<tr>
<td>Turkey</td>
<td>10,660.80</td>
</tr>
<tr>
<td>China</td>
<td>4,300.80</td>
</tr>
<tr>
<td>USA</td>
<td>2,822.50</td>
</tr>
<tr>
<td>Tanzania</td>
<td>2,635.00</td>
</tr>
<tr>
<td>Uganda</td>
<td>2,300.00</td>
</tr>
<tr>
<td>Peru</td>
<td>831.28</td>
</tr>
<tr>
<td>Egypt</td>
<td>566.00</td>
</tr>
<tr>
<td>Mali</td>
<td>540.83</td>
</tr>
</tbody>
</table>

---

### INDIA, GLOBAL LEADER SINCE 3 YEARS

- In 2007 / 2008 India overtook Turkey to become global leader.
- Production in 0708 was 73908 Mts, 50.67% of global
- In 0809, 142347 MTS, 61.41% of global.
- In 0910, 195000 MTs, 80% of Global.

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31
DRAMATIC GROWTH, CRITICAL PROBLEMS........

Many major issues crying out for attention from stakeholders..

Top 3

1. LACK OF INTEGRITY.

2. LACK OF POLICY AND RESEARCH SUPPORT

3. CRITICAL SHORTAGE OF INPUTS, MOST IMPORTANTLY SEEDS.

INTEGRITY IS EVERYONE'S BUSINESS..

On going efforts by concerned stakeholders...

Some efforts by APEDA such as Tracenet and reducing group size.

Much more work needs to be done to have credibility.
Growing markets, growing opportunities.....

Thanks ...for listening....
2.4 Ensuring organic cotton quality and certification today

Mr R. Baruah, Director bioRe India (Ltd), Khargone District, Madhya Pradesh

Ensuring Organic Cotton Quality and Certification

The organic farmers must be provided the highest quality of cotton seeds which meets the stringent requirements of the spinning mills.

The reality is that there is a huge gap between cotton producers and spinners, and this is evident by the fact that at present cotton sells under the labels of:
- H4
- H6

Whereas these Hybrids are no longer being produced commercially.
Farmers to mitigate their risks generally plant 2 to three brands of cotton and these are all mixed up during and picking and hence getting quality data is next to impossible, unless serious efforts are made, and most spinners have no connection to farmers at all.

In the conventional cotton business ginners/spinners buy in the open market select the best cotton from the ‘mandis’.

In case of organic cotton almost all organizations have a purchase guarantee towards the farmers and since most of them provide seeds they are bound to purchase the cotton back from them and cannot be selective of quality.

Certification

Exhaustive work needs to put in to achieve the certification of the farmers in accordance with the Indian Standards of Organic Agriculture. Briefly the steps are as follows:

Training of farmers

Extension services

Mapping the entire fields of the farmers and now marking the same with GPS locations, updating the crops at the time of Kharif and Rabi.

Seeds (untreated) non GMO seeds have to be provided to the farmers, all pest and fertility management activities need to be documented.
Internal inspection data, and all purchase data from each and every farmer needs to be documented accurately. Since May/June 2010 APEDA has launched its Tracenet Software where all farmers details, areas, crops, yield estimations, all purchase information from individual farmers have to entered one line, without this no Certification body will issue any form of certificates.

With this one can see the magnitude of the work that needs to be done, in very very remote areas by personnel who are not necessarily graduates from agricultural backgrounds.

Quote from 9th May HT Indore edition

30 brands of BT hybrids available in the market, last year it was 'rassu' as the most sought after and this US President Obama vs Bollywood Diva Mallika.

As brands multiply it is increasing difficult for cotton farmers to decide on the right seed brand... it there is brand called 'Ganesha' then rival dealers introduce another brand called 'Super Ganesha'. for farmers it becomes a difficult task to select the genuine ones....
2.5 Cotton quality requirements for the industry

Mr D. P. Arya, Pratibha Syntex, Indore, Madhya Pradesh

WORKSHOP ON
DISAPPEARING NON GM COTTON: WAYS FORWARD TO
MAINTAIN DIVERSITY, INCREASE AVAILABILITY AND
ENSURE QUALITY OF NON-GM COTTON SEED

Held At:
University Of Agricultural Sciences
Dharwad (UASD) Karnataka

Presented By:
Mr. DP Arya
GM (VASUDHA)

Pratibha Syntex Ltd

CONTENTS:

- Introduction
- Quality Standards
- Standards Followed @ Pratibha
- Significance of Quality Parameters
- Impact of Quality of Cotton
- Conclusion
**INTRODUCTION:**

- Pratibha is one of the full vertically integrated supplier of all types of knitted textile products including organic and recycled.
- Every step from fiber cultivation to knitted apparel production, is a part of Pratibha and the Vasudha Organic Cotton Farming Project Est. 1999.
- Vasudha Project is supported by technical supervisors and agronomists who closely work with farmers to improve farming practices for increase yields with minimum inputs.

---

**QUALITY STANDARDS (PRATIBHA SYNTEX)**

<table>
<thead>
<tr>
<th>Cotton Parameters</th>
<th>MECH-1</th>
<th>Hy-6</th>
<th>Hy-4</th>
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<tbody>
<tr>
<td>Length (2.5% S.I.)</td>
<td>Above 29</td>
<td>Above 29</td>
<td>Above 28</td>
</tr>
<tr>
<td>Uniformity Ratio</td>
<td>Above 47.5</td>
<td>Above 47.5</td>
<td>Above 47</td>
</tr>
<tr>
<td>Strength (g/tex)</td>
<td>Above 22</td>
<td>Above 23</td>
<td>Above 21</td>
</tr>
<tr>
<td>Elongation</td>
<td>Above 5.5</td>
<td>Above 5.5</td>
<td>Above 5.5</td>
</tr>
<tr>
<td>Micronaire Value</td>
<td>3.8 to 4.40</td>
<td>3.8 to 4.40</td>
<td>3.50 to 4.00</td>
</tr>
<tr>
<td>Neps Cnt/gm</td>
<td>Below 130</td>
<td>Below 100</td>
<td>Below 150</td>
</tr>
<tr>
<td>Trash (%)</td>
<td>Below 3.40%</td>
<td>Below 2.80%</td>
<td>Below 3.50%</td>
</tr>
</tbody>
</table>
SIGNIFICANCE OF QUALITY PARAMETERS

○ FIBRE LENGTH:
  > Fibre length is the average length of the longer one-half of the fibres (upper half mean length). It is reported in both 100ths and 32nds of an inch.
  > SIGNIFICANCE:
  > Fibre length is largely determined by variety, but the cotton plant’s exposure to extreme temperature’s, water stress, or nutrient deficiencies may shorten the length. Excess cleaning and/or drying at the gin may also result in shorter fibre length.
  > Fibre length affects yarn strength, yarn evenness and the efficiency of the spinning process. The fineness of the yarn that can be successfully produced for given fibres is also influenced by the length of fibre.

○ Length Uniformity:
  > Length uniformity is the ratio between the mean length and the upper half mean length of the fibre and is expressed as percentage. There is a natural variation in the length of the fibre, so length uniformity will always be less than 100.

<table>
<thead>
<tr>
<th>Degree Of Uniformity</th>
<th>HU Length Uniformity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High</td>
<td>Above 85</td>
</tr>
<tr>
<td>High</td>
<td>83 - 85</td>
</tr>
<tr>
<td>Intermediate</td>
<td>80</td>
</tr>
<tr>
<td>Low</td>
<td>77 - 79</td>
</tr>
<tr>
<td>Very Low</td>
<td>Below 77</td>
</tr>
</tbody>
</table>
Effect Of Length Uniformity:

- It affects yarn evenness and strength, and efficiency of the spinning process. It is also related to short fibre content (fibre shorter than one-half inch). Cotton with a low uniformity index is likely to have a high percentage of short fibres. Such cotton may be difficult to process and is likely to produce low quality yarn.

FIBER STRENGTH:

- Strength measures are reported in terms of grams per tex. A tex unit is equal to the weight in grams of 1,000 meters of fiber. Therefore, the strength reported is the force in grams required to break a bundle of fibers one tex unit size. The following tabulation can be used as a guide in interpreting fiber strength measurements.

<table>
<thead>
<tr>
<th>Degree Of Strength</th>
<th>HVI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength</td>
<td>Grams per tex</td>
</tr>
<tr>
<td>Very Strong</td>
<td>31 &amp; Above</td>
</tr>
<tr>
<td>Strong</td>
<td>29 - 30</td>
</tr>
<tr>
<td>Average</td>
<td>26 - 28</td>
</tr>
<tr>
<td>Intermediate</td>
<td>24 - 25</td>
</tr>
<tr>
<td>Weak</td>
<td>23 &amp; Below</td>
</tr>
</tbody>
</table>

Fibre strength is largely determined by variety. However, it may be affected by plant nutrient deficiencies and weather.
MICRONAIRE:
- Micronaire is a measure of fibre fineness and maturity. An airflow instrument is used to measure the air permeability of a constant mass of cotton fibres compressed to a fixed volume. Micronaire measurements can be influenced during the growing period by environmental conditions such as moisture, temperature, sunlight, plant nutrients, and extremes in plant or boll population.

SIGNIFICANCE
- It affects processing performance and the quality of the end product in several ways. In the opening, cleaning, and carding processes, low-micronaire, or fine fibre, cottons require slower processing speeds to fibre per cross-section, which in turn produces stronger yarns. Absorbency and retention varies with the maturity of the fibres, the greater the maturity, the better the absorbency and retention.

COLOUR:
- The colour of cotton is determined by the degree of reflectance (Rd) and yellowness (+b). Reflectance indicates how bright or dull a sample is, and yellowness indicates the degree of colour pigmentation.

Effect Of Colour:
- The colour of cotton fibres can be affected by rainfall, freezes, insects, fungi, and stains contact with soil, grass, or the cotton plant’s leaf. Also, excessive moisture and temperature levels affect colour when cotton being stored, both before and after ginning. It also affects the ability of fibres to absorb and hold eyes and finishes.
Trash:
Trash is a measure of the amount of the non-lint materials in the cotton, such as leaf and bark from the cotton plant. Extraneous matter is any substance in the cotton other than fiber or leaf. Examples of such substance is bark, grass, spindle twist, seed coat fragments, dust, and oil. The ratio of trash in the lint should be below 2.5%.

IMPACT OF QUALITY OF COTTON
- Impact on Economy
- Impact on Industry
  - Affects the cotton prices, export prices
  - Major effect on Employment
- Impact on Environment:
- Impact on Health
- Impact on Livelihood
Organic cotton is especially safe for people with allergies and chemical sensitivity as well as for babies and children. Organic cotton has the added advantage of safeguarding the environment, water quality and health of the people who grow, manufacture and use. Choosing organic cotton helps to support organic farmers and gives motivation to conventional farmers who are trying to convert to organic practices.
2.6 Experienced challenges and solutions of Chetna

Mr A. Ambatipudi, Chetna Organic, Hyderabad, Andra Pradesh

Chetna Organic Farmers
Association India

WORKSHOP ON BREEDING NON-GMO COTTON – WAY FORWARD
TO MAINTAIN DIVERSITY, INCREASE AVAILABILITY AND ENSURE
QUALITY OF NON-GMO COTTON SEEDS

Objectives of Chetna

Chetna aims to improve the livelihood (options) of small farm holding households in India through making their farming systems more sustainable and more profitable. These goals will be achieved by undertaking the following:

1. Stabilizing crop yields while promoting ecological farm practices;

2. A 30-50% increase in the returns to farmers;

3. Reduced outlays in health costs

4. Establishing and strengthening self-sustaining farmers owned and managed association and company (COFA & COAPCL);

5. Self-organization - development of entrepreneurship: being a business partner in the textile chain rather than dependent on individual payments by moneylenders/traders (group trading and holding equity at various levels in the supply chain);
Objectives of Chetna (Contd...)

6. **Up-scaling the production of organic/NPM agric. produce** by small holder farmers in India such that volumes become a significant part of mainstream trade.

7. Farms have **improved conditions for labor**;

8. **Enabling Govt. policies** in support of revitalizing rainfed agriculture;

9. **Policy, advocacy and campaigns** relating to institutionalization of responsible credit, insurance and market policies and agro-ecology

**** STARTED in 2004 as an Organic Cotton Intervention Project in rainfed regions of India

The first farmer's field school – **Imparting technical knowledge**

**Farmers:** 234 (19 groups)

**Presence in:** 06 districts in 02 Regions (Andhra Pradesh - Telangana and Maharashtra - Vidarbha)

**Human Resource:** Fulltime (09); Consultants (03)

**Partner NGOs/CBOs:** 05

**Infrastructure:** PMU (Hyderabad) + 03 part time field offices @ cluster level
### CHETNA Progress (2004 – 2010)

<table>
<thead>
<tr>
<th></th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007**</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td># Op. States</td>
<td>32 (AP-MH)</td>
<td>02</td>
<td>02</td>
<td>01 (OR)</td>
<td>03</td>
<td>03</td>
<td>03</td>
</tr>
<tr>
<td># Op. Offices</td>
<td>06</td>
<td>06</td>
<td>06</td>
<td>07</td>
<td>09</td>
<td>09</td>
<td>09</td>
</tr>
<tr>
<td># Villages</td>
<td>14</td>
<td>35</td>
<td>75</td>
<td>450</td>
<td>450</td>
<td>550</td>
<td>571</td>
</tr>
<tr>
<td># Farmers</td>
<td>134</td>
<td>450</td>
<td>300</td>
<td>7,100</td>
<td>5,500</td>
<td>7,100</td>
<td>5,135</td>
</tr>
<tr>
<td># Groups</td>
<td>19</td>
<td>44</td>
<td>78</td>
<td>540</td>
<td>450</td>
<td>550</td>
<td>571</td>
</tr>
<tr>
<td># Cooperatives</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Human Resource
- Fulltime
- Consultants (Part-time)

<table>
<thead>
<tr>
<th></th>
<th>14</th>
<th>20</th>
<th>12</th>
<th>26</th>
<th>30</th>
<th>35</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>03</td>
<td>05</td>
<td>05</td>
<td>01</td>
<td>02</td>
<td>02</td>
<td>05</td>
</tr>
</tbody>
</table>

#### Infrastructure
- PMU (Hyderabads)
- Cluster Offices
- Field Offices

<table>
<thead>
<tr>
<th></th>
<th>06 (+8)</th>
<th>06 (+8)</th>
<th>05 (+3)</th>
<th>05 (+8)</th>
<th>05 (+8)</th>
<th>12 (+8)</th>
<th>12 (+8)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>03</td>
<td>04</td>
<td>05</td>
<td>01</td>
<td>02</td>
<td>03</td>
<td>08</td>
</tr>
</tbody>
</table>

#### Partner NGOs/Govt.

<table>
<thead>
<tr>
<th></th>
<th>06 (+8)</th>
<th>06 (+8)</th>
<th>05 (+3)</th>
<th>05 (+8)</th>
<th>05 (+8)</th>
<th>12 (+8)</th>
<th>12 (+8)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>03</td>
<td>04</td>
<td>05</td>
<td>01</td>
<td>02</td>
<td>03</td>
<td>08</td>
</tr>
</tbody>
</table>

#### Network partners

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>5-7</th>
<th>5-7</th>
<th>5-7</th>
<th>5-7-12</th>
</tr>
</thead>
</table>

#### Marketing of gift (mt. tons)

<table>
<thead>
<tr>
<th></th>
<th>30</th>
<th>120</th>
<th>150</th>
<th>450</th>
<th>400</th>
<th>400</th>
<th>1,200*</th>
</tr>
</thead>
</table>

---

**TODAY**: Chetna supports a membership base of over 8,138 farmers from 290 villages in three states (9 districts) who organized into 571 groups (SHG/CIG) and federated into 9 farmer cooperatives from 290 villages in three states.

**ORISSA (SW)**
- 02 Districts
- 92 Villages
- 2,995 Farmers
- 216 Farmer Groups
- 04 Co-operatives*

**MAHARASHTRA**
- 04 Districts
- 109 Villages
- 3,745 Farmers
- 220 Farmer Groups
- 03 Co-operatives

**ANDHRA PRADESH**
- 05 Districts
- 89 Villages
- 1,998 Farmers
- 125 Farmer Groups
- 02 Co-operatives
Major challenges With Cotton Seeds

• Non-availability of non-Bt cotton seeds
• Need for seeds responsive to organic nutrient management in low input environments

Why this situation arose?

• More than 95% of the cotton area is under Bt
• Companies have stopped producing non-Bt cotton seeds
• The demand for non-Bt cotton seeds is quite less compared to Bt seeds
• Bt is largely promoted by both public & private sector
• Aggressive marketing strategies and lobbying by private seed companies
Challenges for organic cotton projects

- Farmers may get back to conventional cotton production at any point of time and use Bt seeds.
- Proving themselves to be organic increases cost of production for farmers
- Govt. de-notifying certain varieties & hybrids saying it cannot compete in markets with private sector

Seeds ordered and procured by Chetna cooperatives

<table>
<thead>
<tr>
<th>Hybrid</th>
<th>AP (Adilabad)</th>
<th>MH (Yavatmal, Akola, Amaravati)</th>
<th>Orissa (Kalahandi, Bolangir)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Required</td>
<td>Available</td>
<td>Required</td>
</tr>
<tr>
<td>Bunny (NSL)</td>
<td>600</td>
<td>1017</td>
<td>600</td>
</tr>
<tr>
<td>Super Bunny (NSL)</td>
<td>600</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td>Mallika (NSL)</td>
<td>1800</td>
<td>2853</td>
<td></td>
</tr>
<tr>
<td>NH44 (Mahabeej)</td>
<td></td>
<td></td>
<td>600</td>
</tr>
<tr>
<td>PKV 458 (Mahabeej)</td>
<td></td>
<td></td>
<td>500</td>
</tr>
<tr>
<td>Ankurakta</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mauti9632 (Krishidan)</td>
<td></td>
<td></td>
<td>1500</td>
</tr>
<tr>
<td>Ajirika (Mahabeej)</td>
<td></td>
<td></td>
<td>800</td>
</tr>
<tr>
<td>Vijetha (Mahabeej)</td>
<td></td>
<td></td>
<td>300</td>
</tr>
<tr>
<td>Ankur 561</td>
<td></td>
<td></td>
<td>1000</td>
</tr>
</tbody>
</table>
Reasons attributed by seed companies for non-availability of Non-GM Hybrid Seeds

• Completely stopped production due to very less demand
• Converted all their conventional hybrids into Bt.
• Non-remunerative to get into production of conventional hybrids

Chetna’s efforts so far since 2007

• Took trials of ADB-532 and ADB-39 in Adilabad, but performance was very poor.

• The seeds were obtained from Adilabad research station.
Hybrid seeds production

• Obtained parental lines from CSA
• Produced hybrid seeds after which F1 was tried in 1 acre, could get yield of 5 qtls per acre.
• But selfed parental lines didn’t germinate when planned to produce seeds for subsequent years

Hybrid seeds production

• Also obtained another set of parental lines from CSA the seeds production of which has been taken up in Akola, Maharashtra.
• F1 to be tested this year.
Plans for 2011-12

Varietal trials.
• Identified 2 acres of land in each of the project states.
• Obtained 20 varieties of cotton from CICR, SIMA cotton seeds and other local research stations
• Yet to obtain some more varieties from UAS, Dharwad
• All these varieties will be tested in 2 acres plot
• Best performing variety will be multiplied during summer and used for next season.

Hybrid seeds production
• If UAS Dharwad spares parental lines of Varalaxmi, the production will be taken up in 1 acre on trial basis and will be increased in coming years based on the demand.
SEED BANKS

In order to conserve the rich biodiversity and regenerate the erased local varieties of seed, Chetna Organic encouraging its farmer cooperatives to establish the seed banks to collect the diverse seed varieties, test it to document the varietal characteristics and propagate among the farmers.

Respective cooperatives collect the diverse seed varieties from each of the farmers and segregate according to the variety and document each seed varietal characteristics. Farmers are encouraged to collect the varieties from the seed bank at the prescribed rate. Selected farmers will take up the responsibility for the seed production to produce quality seeds which will be purchased by the cooperative for redistribution among its members.

So far, three cooperatives established such seed banks with over 9000 KGS of different varieties of seeds in each seed bank.
COLLABORATION WITH SEED BREEDERS FROM THE FARMING COMMUNITY

Chetna is also identifying the seed breeders of cotton and other crops to collaborate with them for trying the new varieties across the different varieties and popularizing among the farmers. In this context, Chetna identified Neeappa through Sahaja Samrucha, an alliance partner of Chetna on various advocacy campaigns.

FUTURE PLANS

Various traditional varieties of crops (Cereals, oilseeds, pulses, cash crops, fruits, vegetables, and flowers), indigenous livestock and poultry breeds becoming extinct and inaccessible. In this context, Chetna would like to reverse the trend toward extinction of local crop varieties to maintain the diversity.

In this regard Chetna is planning to set up a germplasm conservation centre in Lanjigarh (Orissa) where in all the varieties of crops and rare breeds of animals will be conserved to build it as learning center for the farmers to emulate the similar models of ecological and integrated farming systems model.

Chetna is also planning to expand its efforts on seed production and conservation towards promoting self reliance of the farmers over seeds. However, Chetna requires intellectual and financial resources to scale up and mainstream the interventions over the rigid seed laws in India.
2.7 Experienced challenges and solutions of Pratibha Syntex

Dr S.C. Pandey, Pratibha Syntex, Indore, Madhya Pradesh
Introduction

- Pratibha is one of the world's largest full vertically integrated suppliers of all types of filament textile products including organic and recycled.
- Vasudha Project (founded 1999) aims to expand organic cotton farming culture in India and lead the wave of sustainable change through the SEED Initiative and quality of Non-GM Seed.
- Presently 88% of India's cotton area is grown with genetically modified Bt-cotton,
- In M.P. approximate 90% area is covered with Bt-cotton,
- The Pvt and Public Sector have withdrawn production of Non-GM Cotton Seeds
- The sustainability of the Organic Cotton Projects have become critical.

Present status of Bt Cotton Area in India

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Area</th>
<th>Bt Area lakhs Ha</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002-03</td>
<td>73.90</td>
<td>0.29</td>
<td>0.39</td>
</tr>
<tr>
<td>2003-04</td>
<td>78.35</td>
<td>0.93</td>
<td>1.18</td>
</tr>
<tr>
<td>2004-05</td>
<td>89.70</td>
<td>4.98</td>
<td>5.55</td>
</tr>
<tr>
<td>2005-06</td>
<td>88.73</td>
<td>10.14</td>
<td>11.42</td>
</tr>
<tr>
<td>2006-07</td>
<td>91.58</td>
<td>34.61</td>
<td>37.79</td>
</tr>
<tr>
<td>2007-08</td>
<td>95.06</td>
<td>63.34</td>
<td>66.0</td>
</tr>
<tr>
<td>2008-09</td>
<td>93.73</td>
<td>69.00</td>
<td>73.0</td>
</tr>
<tr>
<td>2009-10</td>
<td>99.85</td>
<td>79.82</td>
<td>79.93</td>
</tr>
<tr>
<td>2010-11</td>
<td>110.55</td>
<td>98.00</td>
<td>88.64</td>
</tr>
<tr>
<td>2011-12</td>
<td>115.00</td>
<td>105.00</td>
<td>91.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>% Bt Cotton</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>96-2010</td>
<td>73</td>
</tr>
<tr>
<td>CHINA</td>
<td>98-2010</td>
<td>82</td>
</tr>
<tr>
<td>INDIA</td>
<td>02-2010</td>
<td>88</td>
</tr>
</tbody>
</table>
### State Wise Split of Bt Cotton In India

<table>
<thead>
<tr>
<th>State</th>
<th>2009-10 (R) (lakh bales)</th>
<th>2010-11 (F) (lakh bales)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Punjab</td>
<td>14.25</td>
<td>16.47</td>
</tr>
<tr>
<td>Haryana</td>
<td>14.73</td>
<td>13.84</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>11.00</td>
<td>6.46</td>
</tr>
<tr>
<td>Gujarat</td>
<td>98.00</td>
<td>106.82</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>63.00</td>
<td>77.31</td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>15.00</td>
<td>18.04</td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>52.00</td>
<td>65.68</td>
</tr>
<tr>
<td>Karnataka</td>
<td>9.00</td>
<td>10.15</td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>5.00</td>
<td>6.71</td>
</tr>
<tr>
<td>Orissa</td>
<td>-</td>
<td>2.00</td>
</tr>
<tr>
<td>Others</td>
<td>1.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Loose Supply</td>
<td>12.00</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>295.00</strong></td>
<td><strong>325.48</strong></td>
</tr>
</tbody>
</table>

---

**Parameters That Influence Cotton Yield**

Cotton yields obviously are not only determined by the farming system (i.e. organic or conventional farming) but also by a number of factors not inherent to the farming system, like site conditions (soil types, rainfall, the quality of seed and other inputs).
Organic Cotton

- Organic cotton is grown using methods and materials that have a low impact on the environment. Organic production systems replenish and maintain soil fertility, reduce the use of toxic and persistent pesticides and fertilizers, and build biologically diverse agriculture.

- Cultivation Requirements:
  - Organic cotton requires greater technical skills as the seed cannot be treated with pesticides.
  - Organic cotton is difficult to grow in areas vulnerable to soil borne diseases.
  - Mineral Nutrition of crops in organic systems comes from proper management of soil organisms that are responsible for releasing nutrition.

Global Organic Cotton Status.

- 23 countries are involved
- India, Syria & Turkey (87% production)
- Global harvested Area 33.3 million hectares 2010-2011.
- Global Yield 754 million hectares (3% up from the previous year
- Area & Production increasing at faster rate
- From 2008 India ranks first in organic cotton production
- Turkey, Syria, China, Tanzania, United States, Uganda, Peru, Egypt and Burkina Faso.
Organic Cotton Production in India

- 80% of the production of Global Cotton from India.
- Certified organic Cereals, vegetables & animal products 25%
- India remained the top producing nation for the year 2009-2010 for the third straight year.
- The country’s output for the year 2009-2010 cotton season is estimated at a record 29.2 million bales of 170 kilograms (kg) each, with cotton cultivated area totaling 10.2 million hectares and yielding 488 kg of cotton per hectare.
- Ministry of Textiles has projected that by 2012 cotton production will total 39 million bales and the yield per hectare will increase to 700 kg.

Organic Status in States & Districts.

<table>
<thead>
<tr>
<th>States</th>
<th>Districts</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.P.</td>
<td>Khandwa, khargoa, indore, dhar, jhabua</td>
</tr>
<tr>
<td>Orissa</td>
<td>Koraput, kalahandi, Bolangir, Ganjam</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>Yoetmal, Dhule, Amravati, Buldana</td>
</tr>
<tr>
<td>Gujarat</td>
<td>Kutch, Surendranagar, Gandhinagar</td>
</tr>
<tr>
<td>West Bengal</td>
<td>Bankura, Purula</td>
</tr>
<tr>
<td>Tripura</td>
<td>North Tripura</td>
</tr>
<tr>
<td>Chhattisgarh</td>
<td>Durg, Raipur</td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>Salem, Erode, Villupuram</td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>Adilabad</td>
</tr>
</tbody>
</table>
Status of organic seed production 2011-2012 (Pratibha Syntex Ltd)

- We have already procured Breeder seed of elite varieties & hybrid parents from renowned institutions agricultural varieties like:
  - CICR Nagpur
  - M.P.K.V Rahuri
  - Marathwada Agril University
  - Parbhani (M.S.)
  - Navsari Agril University (Gujarat)
  - R.V.S.K.V. Gwalior (M.P.)

Seed Production Registration.

- Registration of seed production of organic cotton has been completed for 2011-2012 by M.P. State Seed Corporation, Bhopal
Seed Production

Seed Production Area:
- About 15 – 20 acres of land at near Indore (M.P.) will be sown by procured different varieties & hybrid parents on trial basis during 2011 – 2012.

Seed Multiplication:
- The breeder seeds received from various research institutes/ agricultural universities will be multiplied under our technical supervision and strict inspection by the M.P. State Seed Corp, Bhopal. After certification from this agency these seeds will be distributed to organic farmers as foundation seed during 2012 – 2013 season.

Breeding For Organic Seed:
- The purity of parents of hybrid seed received from various agencies will be maintained and multiplied during 2011-2012 season. After certification these pure seeds of male and female parent will be sown under prescribed isolation of seed certifying agency. The seeds developed after crossing of male and female parents i.e. F1 seed will be distributed to the farmers by us (only certified by certifying agency) which at present is control union.

Quality parameters of breeder seed.

- Breeder seeds of varieties and hybrid parents procured with following specialties
  - Better yield with higher ginning
  - Early maturity varieties and resistance to pest
  - MFL 26mm to 29 mm or more
  - Strength: 22.24 PGT
  - Micronaire: 4 - 4.5
  - Trash: Control Below 2.5%
Challenges In Organic Seed Production

- To convince the farmers the importance of organic farming in cotton.
- To make aware about the parameters that influence cotton yield like
  - Early Sowing Time
  - Inter crop
  - Border Crop/ Trap Crop
  - Better Use of Organic Manure
  - Crop Rotation
  - Crop Health
  - Integrated Biological Pest Management in the crop
  - Non Availability of sufficient organic manures
- Creating awareness by organizing discussion sessions, trainings and publicity about importance of organic seed production.

Conclusion

- Organic farming enhances soil structures, conserve water, mitigate climate change, and also ensures sustained biodiversity through its holistic nature organic farming integrates wild biodiversity and agro biodiversity.
- Organic farming improves farmers livelihoods.
- Organic farming has the potential for more sustainable use of natural resources.
- Organic cotton farming reduces overall vulnerability of farm house holds.
- The potential of organic farming for eradication of poverty can be further improved.
Thank you.
2.8 Experienced challenges and solutions of bioRe

R. Baruah, Director bioRe India (Ltd), Khargone District, Madhya Pradesh

Challenges & Solutions in the procurement of non GMO seeds to Organic cotton farmers at bioRe

By rajeevbaruah for workshop at UASD
21st of June 2011

- Over the past years or so bioRe has been facing a major challenge in the procurement of non GMO seeds, private seeds companies (major seed suppliers) have virtually stopped the production of non GMO seeds, what is available are ‘old’ seeds coming out of cold storages, and hence the quality and productivity of such seeds are in doubt.
Also the multiplicity of seed brands flood the markets each year and this has created a mind set amongst the farmers to try out new brands each year, attractive packages, catchy names are used by some of the seed companies to lure farmers. This becomes a problem for us as we are unable to provide new brands/varieties each year and hence some farmers drop out.

The solutions according to me are as follows:

Collaborate with State Seed Corporations to keep up the seed production of the released cotton hybrids of the state
Collaborate with seed companies to keep up the production of non GMO seeds.
Collaborate with Cotton Scientists and cotton research institutions so that the options of

Collaborate with Cotton Scientists and cotton research institutions and bring the wealth of genotypes that are there in theＨｅｅｐｓ Ｈｏｆｆｅｌｌｓ of the various stations out so that the same can be used by the farmers.

However we really need accurate data on cotton quality, from the research stations, the data must qualify if the testing is done by HVI or ICC mode, and also we need to know if the samples were from the first, second or third picking.

It is based on accurate data of the fiber properties that we can really decide what is best suited for farmers and the spinning industry.
As most of the organic farmers are in the dry and partially rain fed areas, we then need to work with the very competent breeders that we have in India and see how our Arboreums and Herbaceums can be developed further to give us the fibre properties that we need for modern spinning.

Thanks your very much.
2.9 bioRe - FiBL research activities

Dr D. Forster, Research Institute of Organic Agriculture (FiBL), Switzerland

---

FiBL Long-term System Comparison Trials in the Tropics – The Indian Site

Dionys Forster (dionys.forster@fibi.org) 21 June 2011

---

Background: DOK Long-term trial Therwil (BL)

Since 1976, DOK Trial, Therwil (BL), Switzerland

- 8 treatments
- 5 crops in a 7 years' rotation
- 4 replications
- 96 plots à 100m²
- 30 year-trial

FiBL www.fibi.org
Selected results of the DOK trial

<table>
<thead>
<tr>
<th></th>
<th>Organic</th>
<th>Conventional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter wheat yield</td>
<td>4.7 t/ha</td>
<td>5.0 t/ha</td>
</tr>
<tr>
<td>Fertilisation (NH₄NO₃ Equivalent)</td>
<td>122 kg/ha</td>
<td>360 kg/ha</td>
</tr>
<tr>
<td>Energy (Diesel Equivalent)</td>
<td>340 l/ha</td>
<td>570 l/ha</td>
</tr>
<tr>
<td>Plant protection (Active Ingredients)</td>
<td>0-200 g/ha</td>
<td>6.0 kg/ha</td>
</tr>
<tr>
<td>Soil fertility (Microbial Biomass)</td>
<td>40 l/ha</td>
<td>24 l/ha</td>
</tr>
</tbody>
</table>

Mäder et al. (2002), Science 296

Objectives of the long-term system comparison trial

The objective is to quantify:
How organic agriculture (OA) influences:
  - yield and yield stability
  - product quality
  - product storability

How OA influences the agro-ecological system:
  - soil fertility
  - beneficial organisms
  - biodiversity

How OA influences natural and economic resource effectiveness (output/input relationships)
FiBL long-term system comparison trial

Long-term experiment (LTE)

Agronomic on-station experiment

Number: Treatment
Letter: Replication

Example:
A1: Bio-dynamic Treatment
A2: Bio-organic Treatment
A3: Conventional Treatment
A4: Conventional GM Treatment
Participatory technology development (PTD)

Technology improvement for organic farmers

Mother trial (on-station)

Baby trial (on-farm)

Baby trials (on-farm)

System validation

Validation of organic vs. conventional on conventional farms (India)
Project location and trial setup

- Location: Central Indian cotton belt (Madhya Pradesh)
- Eco-zone: Semi-arid tropics
- Agricultural system: Annual fibre and food crops (cash crops)
- Crop rotation:

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton</td>
<td>Soya</td>
</tr>
<tr>
<td></td>
<td>Wheat</td>
</tr>
</tbody>
</table>

- Treatments: (1) Biodynamic, (2) organic, (3) conventional and (4) GM-cotton
- Trial start: May 2007
- Partners: bioRe India Association

India: Trial site

River Narmada

Yield potential: very good
pH: 8.7
Corg: 0.5%
P(01son): 7 mg/kg
Clay: 40%
Altitude: 250 masl
Rainfall: 800 mm
Long-term field trial

Trial design 1st rotation year

- Soya-Wheat
- Cotton

bioRe Association India Training Centre
### Trial design 2nd rotation year

![Diagram of trial design]

### Nutrient application and parameters collected

#### Fertiliser application

<table>
<thead>
<tr>
<th></th>
<th>Conventional &amp; GM</th>
<th>Biodynamic &amp; Organic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synthetic fertilisers</td>
<td>80% of N</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>80% of P</td>
<td></td>
</tr>
<tr>
<td>Organic fertilisers</td>
<td>20% of N</td>
<td>100% of N</td>
</tr>
<tr>
<td></td>
<td>20% of P</td>
<td>100% of P</td>
</tr>
<tr>
<td>Total N and P</td>
<td>As officially recommended and practised by farmers of the area</td>
<td>Approx. 50% of CONV / GM</td>
</tr>
</tbody>
</table>

#### Parameter
- Agronomic parameter (e.g. yield)
- Soil physical, chemical and biological parameters
- Economic parameters (e.g. gross margins)
Preliminary cotton results 2009/10

- ORG and BD cotton were similar to CONV cotton, but GM cotton yielded almost 50% more.
- Production costs in ORG and BD plots were on average about 30% lower compared to CONV and GM plots.
- Without premium price, the gross margins in ORG and BD plots were on average about 9% higher than for average CONV and GM plots.
- With premium price, the gross margins in ORG and BD plots were on average about 30% higher than for average CONV and GM plots.

Preliminary soybean results 2009/10

- ORG and BD soybean yields were between 13 to 18% lower than CONV soybean.
- Soybean yields on GM plots were slightly higher than on CONV plots.
- Production cost in ORG and BD plots were about 60% of the costs in CONV and GM plots.
- Gross margins of ORG and BD plots were on average about 10% lower than on CONV and GM plots.
Preliminary wheat results 2009/10

- Wheat yields were similar for ORG, BD and CONV plots
- On GM plots, wheat yield was slightly higher, probably due to higher residual N
- Production costs in ORG and BD plots were about 30% lower than in CONV and GM plots
- Gross margin in ORG and BD plots were about 20% higher than in CONV and GM plots

PhD project on nitrogen and water dynamics

- Rational: Sufficient nitrogen supply is often critical in organic farming
- Objectives:
  - To investigate N availability and use efficiencies across different seasons in organic vs. conventional production systems
  - To assess the effect of soil moisture availability on previous process
  - To define and test alternative practices for improving N use efficiency (N-UE) in the different systems
  - To model N and water dynamics (net N mineralization, plant N uptake, N leaching, evapotranspiration, water drainage) in each system
- Start: 1 May 2011
Harvested soybeans in LTE  Threshing soybeans in LTE

Flooded fields during monsoon in July 2007 and August 2009
PTD Topics

<table>
<thead>
<tr>
<th>Trial Type</th>
<th>Crop</th>
<th>Mother trial</th>
<th>Baby trial</th>
<th>Demo Plot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivar screening</td>
<td>Cotton</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Phosphate rock</td>
<td>Cotton, Soybean, Wheat, Mung bean, Maize</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Leguminous green manure crops</td>
<td>Sesbania, Crotalaria, Gliricidia</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

PTD Rock Phosphate trial on-station (Mother Trial)

- Objective: To evaluate the effect of different rock phosphate treatments on various crops → develop best practices → increase nutrient use efficiency
- Treatments:
  T1) Soil alone
  T2) Rock phosphate alone
  T3) Compost alone (4 t/ha)
  T4) Compost with rock phosphate (100 % P2O5)
  T5) Compost with rock phosphate (200 % P2O5)
  T6) Compost with rock phosphate, treated with Phosphorus Solubilising Bacteria (PSB)
  T7) Compost with rock phosphate, treated with Tamarind Solution (TS)
  T8) Compost with rock phosphate, treated with PSB + TS
  T9) Compost with rock phosphate, treated with Tamarind leaves
- Block size: 16 x 11 m; plot size: 5 x 3.5 m
- Randomized complete block design (RCBD) with 4 replications
PTD Rock phosphate trial on-farm (Baby Trials)

- Treatments: Similar to on-station experiment
- Treatment combination:
  - T3-T4-T8-T9
  - T3-T4-T7-T9
  - T3-T4-T8-T9

- Baby trials (on-farm) in 4 villages, 39 farmers, 3 groups

- Randomized allocation (Plot size 50 m²)
PTD Topics

<table>
<thead>
<tr>
<th>Trial Type</th>
<th>Crop</th>
<th>Mother trial</th>
<th>Baby trial</th>
<th>Demo Plot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivar screening</td>
<td>Cotton</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Rock Phosphate</td>
<td>Cotton, Soybean, Wheat, Mung bean, Maize</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Leguminous green manure crops</td>
<td>Sesbania, Crotalaria, Glicidia</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Green manure trial on-station (Mother Trial)

- Objective: To explore different annual and perennial alley cropping systems on-station and on-farm.
- Treatments:
  - AC$_{an}$: Annual alley cropping system with pigeon pea and chilli
  - AC$_{pr}$: Perennial alley cropping system with (Glicidia and Leucaena)
  - Annual crop rotation: cotton – soybean – wheat
- Block size: 16 x 12 m; plot size: 12 x 8 m
- Randomized complete block design (RCBD) with 4 replications
Validation trial

- Objective: To validate organic and conventional production systems under farm conditions.
- Treatments:
  - A: Compost alone (4 t/ac, organic repellents)
  - B: Farmer's practice (usually FYM + NPK, synthetic pesticides)
  - Annual crop rotation: cotton – soybean – wheat
- Field size: 1 ac; plot size: 0.5 ac, subplot size 3 x 3 (soybean and wheat) and 7 x 7 (cotton).
Validation trial design

Conv (1/2 ac)

Org (1/2 ac)

Sub-Plot

Young H12 cotton variety in a validation trial
Validation trial – Threshing of Soybeans

Separation of yield

bioRe research team
Thank you for your attention!
2.10 bioRe - Cotton screening (on-station, on-farm)

R. Verma, Research Manager bioRe India Association, Khargone District, Madhya Pradesh

PTD GMO - ConHybrid - ORG Cotton Trial – 10P6

Objective: To investigate the physiological development, to assess the yield potential and cotton fibre quality of available cotton: organic, conventional hybrid and Bt cultivars.

Indicators:
- Yield in treatments
- Plant health
- Growth parameters cotton (i.e. no. plants, no. bolls, no. sympodia)

Trail design

Treatments:
- A) Organic seed (same cultivar as in long-term system trial) JK DURGA
- B) Conventional hybrid cultivar H 12
- C) Conventional hybrid cultivar SURAJ
- D) Conventional hybrid cultivar HY 102
- E) Bt seed (same cultivar as in long-term system trial) JK DURGA BT

Treatment allocation:
- Randomise Complete Block Design

Trial allocation:
- Crop Library Plot No 5 and 6
Design Parameters:
- Plot size: 158.4 m²
- No. of plots/field: 2
- No. of treatment levels: 2

Plant Spacing:
- Planting spacing: 1 m x 0.9 m (row spacing 1 m; intra-row distance 0.9 m)
- 12 plants in each row.
Seed Treatment:
- Plot 1: Biogas slurry + Neem leaf extract
- Plot 2: Imidachloropede 70% SL (Gaucho) @ 3ml/kg seeds. Do only treat organic seed

Fertiliser:
- Plot 1: 8500 kg compost/acre → 336 kg compost/plot
- Plot 2: 2500 kg compost/acre → 99 kg compost/plot
  125 kg urea/acre → 4.0 kg urea/plot
  210 kg SSP/acre → 8.3 kg SSP/plot
  65 kg MOP/acre → 2.6 kg MOP/plot
Field Preparation:
- Ploughing, harrowing, levelling as for plots in big trial
- Sow one seeds per location based on seed germination test in seeing plates
- Thin after 30 and 50 DAS to 1 plant

Plant Protection:
- Plot 1: Neem + cow urine spray at 15 days interval, Garlic-onion-chili repellent, Top-ten spray
- Plot 2: Pesticide + Fungicide

Parameters collected
- Plant health
  - Pests (feeding damage, pest system)
  - Diseases (coloured leaves, necroses)
- Growth parameters Cotton
  - Stem diameter
  - Monopoda/Sympodia
  - No sympodia
  - Plant height
  - No pin head (at time X)
  - No of flowers and colour at 1st, 2nd, 3rd, .. picking
  - No open balls (1st, 2nd, 3rd, .. picking)
  - No closed balls (1st, 2nd, 3rd, .. picking)
  - No harvested balls (1st, 2nd, 3rd, .. picking)
  - Yield per row (1st, 2nd, 3rd, .. picking)
Parameters to be collected (cont.)

- Cotton fibre quality
  - Sample weight
  - Seed weight
  - Lint weight
  - Seed index
  - Staple length
  - Fibre fineness

- Photo monitoring
  - 1 randomly selected line in low input level
  - 1 randomly selected line in high input level

Photo monitoring Plot No 6

Block I  Block II  Block III

The plants should be tagged with small hard paper tags. Photos should be taken every month (start with DAS 0).
Conclusion

- Cultivars performed slightly better under conventional treatment.
- JK Durga & H-12 both achieved higher yield than the Suraj & Hy-102.
- Overall JK Durga performed best.
- JK Durga non-GM performed better than JK Durga GM in both low input & high input treatments.
- Selection of JK Durga for long-term experiment, cropping season 2011-12.
2.11 Cotton Seed Multiplication
Raja Shekar and Tara Singh, Centre for Sustainable Agriculture, Hyderabad, Andra Pradesh

COTTON SEED MULTIPLICATION

Disappearing non-GM cotton—way forward to maintain diversity, increase availability and ensure quality on non-GM Cotton seed

Raja Shekar and Tara Singh
Centre for Sustainable Agriculture

Centre for Sustainable Agriculture

• is an independent agriculture institution working to establish sustainable models of production through a community managed learning, management and marketing system.
• strive for a policy change which promote sustainable models of production and bring restrictions on ecologically and economically unsustainable practices and polices
Cotton farmers: Current scenario

Caught in a debt trap
- High input costs
- Uncertain inputs
- Uncertain market prices

Linked to farmers suicides
- 1987 prakasham, guntur dist. > 100 farmers committed suicides, several migrated
- 1997 warangal, karimnagar dist > 750 farmers committed suicides
- 2004 all over the state >1500 farmers committed suicides . this time not just cotton farmers
Cotton contaminated

- Contamination with GM
  - Genetic contamination (5-15 %)
  - Physical mixture (5-30 %)
- Implications
  - Loss of biodiversity
  - IPR implications
  - Market implications

Reasons for contamination

- Transgenes flow with normal reproductive processes
- Move when a plant carrying a transgene moves to a new environment, via seeds or propagules
- Possibility of contamination in the physical handling and human-mediated processes (admixtures)
- Scale issues affect estimates of pollen-mediated gene flow
Photos:
On the top left, a seed producer in Gujarat who is growing non-Bt Cotton seed on the right and Bt Cotton seed on the left, with no isolation distance at all.
Top right - a farmer in Andhra Pradesh with distance between seed production plot and commercial Bt Cotton plot of two different companies being just around 4-5 feet.
Left - no isolation distance between two different seed production plots, Andhra Pradesh.
HOMEBRED COTTON

- Initiated in the year 2004-05 in Warangal and Khammam dist. AP.
- Male and Female lines were evolved by participatory plant breeding from public sector var. –Narasimha, BN-1 and N-1, NHH 44
- In the year 2007, male and female lines were stabilized
- F1 production was initiated in 2008
RC purma female and male

Yenabavi homebred

Rainfed condition
- No. of bolls/plant: 26.9
- Boll wt (g): 3.5
- Staple length: 26 mm - 28 mm
- Space: 40 x 26 inches
- Yield: 4.5 q/acre

Irrigated condition
- YS-2
- No. of bolls/plant: 50.1
- Boll wt (g): 4.9
- Yield: 9.3 q/acre
RC Puram homebred (2009)

Rainfed condition

- No. of bolls: 52.4
- Boll wt (g): 5.9
- Staple length: 30mm - 33mm
- Space: 40 X 28 inches
- Yield: 9.5 q/acre

Table 7: Hybrid cotton seed production 2010

<table>
<thead>
<tr>
<th>S-No</th>
<th>NGO/Dist.</th>
<th>Name of the Hybrid</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MARII-Warangal</td>
<td>RC puram Hyb.</td>
<td>2 Cents</td>
</tr>
<tr>
<td>2</td>
<td>CROPS</td>
<td>RC puram hyb</td>
<td>3 Cents</td>
</tr>
<tr>
<td>3</td>
<td>SECURE-Khammam</td>
<td>RC puram hyb</td>
<td>10 Cents</td>
</tr>
<tr>
<td>4</td>
<td>PSS-Warangal</td>
<td>Eheabavi hyb.</td>
<td>30 cents</td>
</tr>
<tr>
<td>5</td>
<td>Zameen organic-Adilabad</td>
<td>RC puram NhM 44</td>
<td>50 cent</td>
</tr>
<tr>
<td>6</td>
<td>Chetani organic-Orissa</td>
<td>RC puram hyb.</td>
<td>20 cents</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eheabavi NhM 44</td>
<td>95 Cents</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NhM 44</td>
<td>2 cents</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>1.15 Ac</td>
</tr>
</tbody>
</table>

From 1.15 Ac, we have produced around 300 packets of F1 @ 450 gms each. Kharif 2011 - F1 cotton seed production was taken in 5 Ac.
sowing

Emasculation and crossing
Yenabavi F1

Selfing to maintain male and female lines
Further details

Centre for Sustainable Agriculture
12-13-445, Streetno.1, Tarnaka
Hyderabad-500 017, AP, India
Email: csa@csa-india.org
Web: http://www.csa-india.org
http://www.indiagminfo.org

The learnings are from the projects supported by
Hivos, Netherlands
ASW, Germany
2.12 Perspectives and outlook for India's non-GM cotton in future

Dr S.S. Patil, Senior cotton breeder ARS Dharwad Farm Dharwad, UAS Dharwad, Karnataka
Problems have arisen with Hirsutum based cottons

However, the greed for higher income involving over exploitation of hirsutum and barbadense based cotton genotypes has led to this unhealthy situation of rise and fall of the remunerative value of cotton.
Maintaining stable equilibrium of pests, predators and cotton; no war but peace in the Eco system

- It is necessary to soften the ecosystem and purify it from the presence of harsh chemicals - in turn the hostile strains of pests - cotton cultivation system with the optimum expectations (not greed for very high income) of remuneration from cotton.
- Harmonious co-existence of cotton plant, farmer, pests and predators
- Message needs to be communicated to farmers, policy makers, politicians
- They have to be educated about these through training programs, seminars etc...

Shift in the species composition of cotton: Promotion of Desi Cottons

Desi cottons, where prominently grown at the time of independence (97%) by 1990’s this proportion was reduced to 28 (%) and now in 2010 less than 10%.

Decline in demand for non GM varieties and hybrids

Desi cotton Eco-system

Desi cottons are inherently tolerant to both biotic and abiotic stresses, because of these species are grown with minimum chemical intervention in the ecosystem almost organic

Remunerative value has never declined and no reports of suicides.
### Non GM cotton: what is grown where?

<table>
<thead>
<tr>
<th>Desi cottons</th>
<th>Variety Name</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herbaceum</td>
<td>Jayadhar, Renuka RAHS-14 DDHC-11</td>
<td>Karnataka</td>
</tr>
<tr>
<td></td>
<td>G cot series</td>
<td>Gujarat</td>
</tr>
<tr>
<td>Arboraeum</td>
<td>AK235, DLSA-17</td>
<td>Karnataka</td>
</tr>
<tr>
<td></td>
<td>AK235</td>
<td>Maharashtra</td>
</tr>
<tr>
<td>Hirsurum</td>
<td>LRA5166, Sahana, RAH-100</td>
<td>Summer cotton belts of Karnataka</td>
</tr>
<tr>
<td></td>
<td>LRA5166 and Surabhi</td>
<td>Sundarban (West Bengal)</td>
</tr>
<tr>
<td>H x H Hybrids</td>
<td>Some Private And Public Sector and other hybrids</td>
<td>Organic cotton fields of different states</td>
</tr>
<tr>
<td>Barbadese</td>
<td>Suvin</td>
<td>Parts of Tamilnadu Karnataka on contract basis mostly on non-organic situation</td>
</tr>
<tr>
<td>H x B hybrids</td>
<td>DCH-52, Veralakshmi and Others</td>
<td>Parts of south Karnataka and Madhya Pradesh</td>
</tr>
</tbody>
</table>

---

### Tale of the transition Phase from Non Bt to Bt Cotton

- The switch over from Non Bt to Bt was very quick.
- Some leading Non-Bt hybrid seeds brands and State Seed Corporations could not liquidate seed stocks due to the fast declining demand for Bt cottons and this even lead to financial losses.
- These stocks could find Lucky usage as Refugia
- Even exchange of these hybrid seeds between companies for fulfilling requirement of Non Bt seeds
- **At Present** any cotton genotypes (variety or hybrids) is permitted to be used as Refugia and soon redgram is being considered as alternative to this
Present Perception of Private Sector

- There is limited scope for non-Bt hybrids.
- Minimized focus on the usage of non-Bt lines in their research programme.
- Programme on developing conventional mechanism of tolerance to bollworms are shelved.
- The present cultivated Bt hybrids may have one non-Bt and another Bt parent.
- We may foresee a situation where more and more released hybrids have both Bt parents.
- Most seed companies do not want to continue developing non-Bt cotton varieties and hybrids?
- Can we say this is causing Erosion ????

Shrinking seed source of non-GM cotton

- Cost of hybrid seed production increasing private sector is not interested in producing even state seed corporation are disowning their social responsibility of producing non-GM cotton seeds of even desi cotton varieties required by poor farmers for rainfed eco system
Increasing Cost of HYBRID Seed

- Hybrid seed production cost is increasing.
- Seed production farmers insisting on Bt gene in parents so that seed production cost is minimized.
- Recently revision of sale prices of Bt cotton seeds was approved in different Indian states.
- No Takers of non-Bt cotton hybrid seed production
- Seed cost of non Bt cotton expected hybrid seeds production expected to be higher than Bt cotton hybrids.

Organic cotton groups should help themselves

- Should develop their own source of hybrid seed production and acquire Self sufficiency for hybrid seed need.
- Backyard seed production family members also can spare time to produce hybrid seeds.
- Farmers are self responsible for purity of hybrid seeds.
- No scope for exploitation.
- Some private sector companies are interested in producing required quantity of non-Bt cottons.

Undesirable(?) Features of Successful Bt Cotton hybrids

- Reduction in emphasis on conventional mechanism of resistance to boll worms such as tolerance, Antibiosis and Non-preference.
- This is the kind of erosion seen with in Hirsutum species.
- If future the Bt genes fail to function the cotton crop will be susceptible to bollworms.
- Very important to maintain and promote non-Bt and organic cotton cultivation. Promotion of non-Bt cottons in organic situation helps in saving ecosystem from usage of harsh chemicals. Purify ecosystem helps in encouraging genetic source of conventional resistance to bollworms and maintain genetic diversity and prevent genetic erosion.
- Bt gene induced mismatch between source and sink lead to reduction in yield and harvest index in upper half, reduction in rejuvenating capacity in many hybrids. Hence increased photosynthetic ability, stay green nature become all the more important in genotypes utilized for breeding or Bt cotton.
Variety v/s hybrids in Organic Situation

- Hybrids reveal high heterosis and vigour. Hybrids are more productive varieties.
- Varieties can also be improved thereby leading to increase in their genetic control (yielding ability). Bringing them closure in potentiality to hyrids.
- Lost of varietal seeds will be negligible as compared to hybrids (Rs 20 vs Rs 2000/kg).
- This saving matters all the more especially in marginal soils dry land situation, saline situation etc and also incase of poor farmers.
- Farmers can multiply his own seeds under some simple guidance from breeders.

- Varieties are thus a long term solution especially in less productive situation

<table>
<thead>
<tr>
<th>Situation</th>
<th>Variety</th>
<th>Hybrid</th>
<th>Variety</th>
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<tr>
<td>intensive</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>High</td>
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<tr>
<td>marginal</td>
<td>Low</td>
<td>high</td>
<td>low</td>
<td>Extremely high</td>
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</table>

In Indian situation private sectors breeder have minimized the usage of non-Bt lines in their Working germplasm involved in hybrid research

- Public sector breeders are producing non Bt hybrids available in the market

In our trials every year 20-30 non Bt hybrids > Bt check hybrids in artificially protected situation. This confirms the genetic potentiality of the material available with the public sector breeders.

Interest of private seed industry

<table>
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<tr>
<th></th>
<th>Bt cotton</th>
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<th>Abroad</th>
<th>Role of public sector</th>
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<td>yes</td>
<td></td>
<td>yes</td>
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<tr>
<td>Hybrid</td>
<td>Slowly becoming difficult and cost is increasing</td>
<td>Not feasible Hybrid seed production is not viable</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>Non- Bt cotton</td>
<td>no</td>
<td>--</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>variety</td>
<td>Very limited interest</td>
<td>Very limited interest</td>
<td>yes</td>
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</table>
In developed countries regulations are strict and the system of royalty flowing to the seed company encourages the seed industry to release variety and the farmers returns to buy the seed every year.

In India, companies fear that he will not come back again for seed.

---

**How can The trend of genetic erosion: can we reverse it?**

- The trend of decline in focus on conventional mechanism of boll worm tolerance leads to genetic erosion.
- A successful genotype in non-Bt ecosystem has to possess strong conventional mechanism of resistance.
- Breeding genotypes for this situation will enrich the germplasm with bollworm resistance genotype. It should have been lost otherwise.

- Presently there is free usage of chemical pesticides in the ecosystem in which we breeders are developing potential non-Bt cotton varieties. There again focus on conventional mechanism of resistance is lost.
Scope for enhancing ELS cotton production

- Price of ELS cotton is increasing
- International market demand will continue to increase
- Earlier there was problem of low productivity of Suvin
- Now many new barbadense varietal lines are available which are improved in productivity and fibre quality
- Organic farmers are demanding DCH 32 seeds while we have dozens of hybrids distinctly better than DCH32 and even best Bt cotton hybrid
- Need for testing them across locations representing organic cultivation and ensure that genotypes are identified exclusively

Increase in labour cost has its impact on the cost of cultivation

- It has necessitated high density planting and use of machines for picking cotton
- Compact early maturing varieties are the best choice for this situation
- This can facilitate and promote double cropping in cotton ecosystem.
- Public sector can play important role in developing non-GM compact varieties of cotton.
Contamination by Bt cotton

- Non Bt material is surrounded by Bt cotton, cross pollination takes place to an extent of 20% It can be still higher when people activity moving in research plots containing Bt and Non- Bt in adjoining plots.
- Many of the varietal genotypes are heavily contaminated
- For a breeder developing a non Bt cotton, It is a bigger problem in handling population after hybridization While practicing selection of potential plants contaminated Bt cotton plants are attractive and more productive
- Before realizing this mistake, lot of potential Non Bt plants would have been rejected.

Maximum care should be taken to prevent this while
a) Maintaining and multiplying a variety
b) Practicing selection and developing new varietallines.

How do we Develop Varieties exclusively for organic situation

- Farmers participatory development of cotton varieties for organic situation
- Development of Self sufficiency for seed needs
- Even hybrid seed production can be taken up at farmers level
Present Methods of testing and release of Cotton varieties/Hybrids

- Present system prevailing for identifying genotypes for irrigated and rainfed situations in different cotton zones in ICAR system

- Releasing varieties at state level based on multi location trials and testing of genotypes

- There is a need to introduce new trials of testing cotton genotypes in ICAR system for Indian organic belts

- Existing organic farmers fields, testing farms of NGOs cotton research stations of SAUs and central cotton institutes can be used for testing cotton genotypes
3 Dharwad Declaration 21\textsuperscript{th} June 2011

Disappearing non-GM cotton – ways forward to maintain diversity, increase availability and ensure quality of non-GM cotton seed

This declaration is made at the national workshop on „Disappearing non-GM cotton – ways forward to maintain diversity, increase availability and ensure quality of non-GM cotton seed“, organised by bioRe India (Ltd), the Research Institute of Organic Agriculture (FiBL Switzerland) the University of Agricultural Sciences Dharwad (UASD) and supported by other stakeholders. Scientific guidance was given by Dr. S. S. Patil and his team (UASD) who have many years of experience and an outstanding reputation in cotton breeding.

Cotton, a cash crop of India’s rural economy is livelihood of about four million farmers. The adjacent textile industry employs another three million persons. In 2008, India has become the second largest cotton producer just after China. While seed cotton yield levels were rather modest (270 kg/ha) after independence, they steadily increased and reach on average up to 1820 kg/ha. The success of cotton improvement can mainly be associated to the coordinated efforts of farmers, breeders, agronomists, entomologists, pathologists and physiologists. Their commitments lead to the release of the world’s first intra-specific Gossypium hirsutum hybrid cotton (HYBRID-4) in 1971. Besides indigenous Desi cotton varieties are native to India and provide sought-after characteristics such as hardiness, pest resistance and drought tolerance. Despite, this area under Desi cotton is fast declining. Nowadays Indian farmers grow 90% hirsutum, mainly hybrids, of which 90% is GM cotton. Thus, Desi cotton will only survive if yields and fibre quality will improve and the maturity period reduced. During the last two decades organic cotton production has gained increasing interest worldwide, but especially in India. The country has become the world’s largest organic cotton producer. Up to 80% of world’s organic cotton is reported to be produced in India. Also the global market for organic cotton products increased from 1.97 to 4.3 billion USD in 2007 and 2009, respectively. However, this market is threatened by the erosion of conventional varieties by GM cotton. Since the market for non-GM seed has become completely eroded, there is little interest by private seed companies to further invest in this sector. On the other hand, farmers have lost their traditional knowledge on seed production. Hybrid seeds have to be purchased each season and therefore cotton farmers depend today on a diminishing supply of non-GM cotton seed. Recent experience has been that available non-GM seeds has dubious quality (expired, chemically pre-treated, segregated) and based on only a few hybrids selected for responsiveness to fertilizer and chemical pest control that might not be adapted to their rain-fed, low input conditions. Moreover, there is a big risk of physical and genetic contamination of organic cotton with GM cotton and the loss of locally adapted genetic resources.

Breeding cotton varieties and hybrids to suit different agro-ecological regions and providing quality cotton to meet the needs of the cotton sector has always been the priority of cotton breeders in India. The University of Agricultural Sciences, Dharwad has been a pioneering institute involved in developing cotton varieties and hybrids for over a century. The university has thus some of the best Indian cotton breeders and the greatest cotton germplasm bank in India. The disappearance of non-GM cotton in India and the awareness for genetic erosion convinced concerned stakeholders of the organic movement to give high priority to this issue.
The participants jointly declare that immediate action is needed to improve seed availability, seed access and seed quality of non-GM cotton varieties adapted to organic and low input conditions. In particular we support activities in the following areas:

Collaboration and exchange:
- Gathering and facilitating exchange of information, techniques and genetic material among stakeholders;
- Pooling volume of producers seed demand and try to attract public and private cotton seed companies and organize an annual meeting to update on seed quantity needs;
- Promoting public-private partnerships for non-GM cotton and the active involvement and collaboration of public cotton research, pre-breeding, breeding and multiplication with organic cotton producers, processors and private seed companies;
- Forming a forum consisting of project heads, NGOs, farmer groups and other stakeholder to do policy advocacy.

Desired Policy Changes:
- Focusing policy and public research on conservation, multiplication and breeding of non-GM seed;
- Installing a board for organic cotton with financial and implementation powers;
- Continuing dialogue with policy makers;
- The provision for the safe guard of organic farmer from contamination of GM crop has to be included in the seed act;
- Declare ecologically sensitive zones (i.e. around national parks) GM-free.

Evaluation and multiplication of existing cotton varieties under organic and low input conditions:
- Local testing and multiplication of existing non-GM cotton varieties on-station and on-farm under various conditions;
- Maintaining and utilising of genetic diversity of non-GM germplasm in situ, especially of Desi cotton, to be prepared for future challenges of climate change.

Establishing and optimizing the non-GM cotton seed value chain:
- Implementing stringent preventive measures to avoid physical and genetic GM contamination;
- Identifying specific non-GM areas for seed production;
- Installing seed quality testing that can be implemented by farmers organizations, including test for GM contamination;
- Establishing seed data base on availability of seeds and results from variety trials, especially fibre traits under different growing conditions;
- Training farmers in seed multiplication, processing and storage;
- Empowering farmers and farmer groups to set up own seed business;
- Bringing valuable germplasm of public institutions to farmers” fields.

Continuous improvement of non-GM varieties:
• Breeding non-GM cotton for high and stable yield and tailor-made quality for rain-fed low input conditions in isolation from GM fields;
• Promoting participatory breeding approaches including breeders, farmers, researcher, processor, seed traders and spinning industry;
• Taking special attention for local adaptation, nutrient and water use efficiency, natural mechanisms against pest and diseases, niche markets and extreme weather events;
• Utilizing broad germplasm including the indigenous Desi cotton and other Gossypium species;
• Improving also inbred seed varieties for the option of farm saved seeds;
• Releasing varieties explicitly for organic and low input;
• Training farmers to produce their own seed.

To achieve these goals we join forces and partner in non-GM cotton seed issues to secure non-GM seed availability and genetic diversity over long-term.

Dharwad, 21 June 2011

Signed by: Dr. L. Savariraj, Sawed Trust; Dr. M. Abdaheer, Sawed Trust; A. Ambatipudi, Chetna Organic; D. P. Arya, Pratibha Syntex; Dr. A. Barik, DOCD Mumbai; R. Baruah, bioRe; V. Carriappa, Savayava Krishikar Sangha, HD Kote; M. Chinnaswami, Appachi Cotton; G. R. Dharmendar, Chetna Organic; Dr. D. Forster, FiBL; O. Gadade, Cotton Connect; P. V. Gaonkar, UAS Dharwad; A. Katyal, Sunstar Overseas Ltd; H. G. Kencharaddi, UAS Dharwad; M. Kunz, Remei AG; S. Makari, SOFA; Dr. M. Messmer, FiBL; P. Nagarajan, Textile Exchange; H. Patel, Agrocel; Dr. B. C. Patil, UAS Dharwad; Dr. S. S. Patil UAS Dharwad; K. Prasad, Sahaja Samrudha; G. Rajashekar, Centre of Sustainable Agriculture; M. Ramakrishnan, Arvind Limited; H. M. Ranganatha, UAS Dharwad; D. N. Reddy, Chetna Soceity; S. P. Reddy, UAS Dharwad; A. Roy, Ram Krishna Ashram Krishi Vigyan Kendra; K. Sainathan, Agrocel; M. S. Sunstar Overseas Ltd; R.T. Singh, Centre of Sustainable Agriculture; Dr. M. V. Venugopalan, CICR.
Annex

Annex 1: Programme

Disappearing non-GM cotton – ways forward to maintain diversity, increase availability and ensure quality of non-GM cotton seed

21st of June Tuesday

<table>
<thead>
<tr>
<th>Start</th>
<th>Activity</th>
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<tbody>
<tr>
<td>08.15 AM</td>
<td>Registration of delegates</td>
<td>All</td>
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<tr>
<td>09.15 AM</td>
<td>Welcome to the National Workshop on Disappearing non-GM Cotton</td>
<td>S.S. Patil</td>
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<tr>
<td>09.25 AM</td>
<td>Invocation</td>
<td>Ms Shilpa</td>
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<tr>
<td>09.30 AM</td>
<td>Welcome of the delegates, introduction of the delegates and the need for this workshop</td>
<td>Mr R. Baruah</td>
</tr>
<tr>
<td>09.50 AM</td>
<td>Inauguration</td>
<td>Dr D. Forster</td>
</tr>
<tr>
<td>09.55 AM</td>
<td>Inaugural address</td>
<td>Dr D. Forster</td>
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<tr>
<td>10.00 AM</td>
<td>Presidential remarks</td>
<td>Dr B.M. Khadi</td>
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<tr>
<td>10.20 AM</td>
<td>Vote of thanks</td>
<td>Dr B.C. Patil</td>
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<td>10.30</td>
<td>Break and group photo</td>
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<tr>
<td>11.00 AM</td>
<td>Cotton Seed Development Strategies</td>
<td>Dr A. Barik</td>
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<tr>
<td>11.30 AM</td>
<td>CICR: fostering linkages to support organic cotton programmes</td>
<td>Dr M.V. Venugopalan</td>
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<tr>
<td>11.45 AM</td>
<td>Organic cotton markets and challenges</td>
<td>Ms P. Nagrajan</td>
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<tr>
<td>12.00 AM</td>
<td>Ensuring organic cotton quality and certification today</td>
<td>Mr R. Baruah</td>
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<tr>
<td>12.15 AM</td>
<td>Short discussion</td>
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<tr>
<td>12.30 AM</td>
<td>Cotton quality requirements for the industry</td>
<td>Mr D.P. Aria</td>
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<tr>
<td>12.45 AM</td>
<td>Experienced challenges and solutions of Chetna</td>
<td>Mr A. Ambatipudi</td>
</tr>
<tr>
<td>12.50 AM</td>
<td>Experienced challenges and solutions of Pratibha Syntex</td>
<td>Dr S.C. Pandey</td>
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<tr>
<td>01.00 PM</td>
<td>Experienced challenges and solutions of bioRe</td>
<td>Mr R. Baruah</td>
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<td>Time</td>
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<tr>
<td>01.10 PM</td>
<td>Short discussion</td>
<td>All</td>
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<tr>
<td>1.00 PM</td>
<td>Lunch</td>
<td>All</td>
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<tr>
<td>2.00 PM</td>
<td>bioRe - FiBL research activities</td>
<td>Dr D. Forster</td>
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<tr>
<td>2.30 PM</td>
<td>bioRe - Cotton screening (on-station, on-farm)</td>
<td>Mr R. Verma</td>
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<tr>
<td>2.50 PM</td>
<td>Seed multiplication and breeding for organic</td>
<td>Mr R. Shekar, Mr T. Singh</td>
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<td>3.10 PM</td>
<td>Short discussion</td>
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<tr>
<td>3.25 PM</td>
<td>Perspectives and outlook for India's non-GM cotton in future</td>
<td>S.S. Patil</td>
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<tr>
<td>4.00 PM</td>
<td>Break</td>
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<td>4.15 PM</td>
<td>Discussion and formulation of declaration for increasing availability and ensure quality of non-GM (low input/organic cotton) cotton seed in future</td>
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<tr>
<td>8.00 PM</td>
<td>Dinner</td>
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Annex 2: Participant List

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<th>Name</th>
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<tbody>
<tr>
<td>Mr</td>
<td>Arun</td>
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<tr>
<td>Dr</td>
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Annex 3: Photographs

Inauguration ceremony with bioRe Director R. Baruah, FiBL Chief Guest Dr D. Forster, H"ble Vice Chancellor UAS Dharwad Dr B.M. Khadi, Director Extension UAS Dharwad Dr. L. Krishna Naik, and Director DOCD Dr A. Barik (fltr), (Photo: FiBL).

Workshop participants in the front of Dr. S.A. Patil Administrative Block of the University of Agricultural Sciences, Dharwad, (Photo: FiBL).
Senior Scientist Dr. S.S. Patil from the Agricultural Research Station Dharwad Farm, UASD, Dharwad, during his exciting speech on “Perspectives and outlook for India’s non-GM cotton in future” (Photo: FiBL).
Annex 4: Press Coverage
