Progression of Indian Seed Industry

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Agenda of the presentation

- Global Seed market
- World Food Demand

- Indian Seed market
  - Size
  - Crop profile
  - Structure
  - Value chain Stakeholders
  - Growth drivers

- Interventions and Impact
  - Product quality & SRR
  - Government Interventions
  - Other interventions
Global Seed Market

- Total Market Size: USD 45 Billion, growing at a CAGR of 5%
- India ranks 6th in global market with USD 2.7 Billion, growing at a CAGR of 12%
- Malawi seed market with USD 0.3 Bn

### Estimated Value of Global Seed Market in Selected Countries 2011 (USD Bn)

- USA: 12.0
- China: 10.0
- Brazil: 2.8
- Canada: 2.6
- India: 2.1
- Japan: 2.0
- Germany: 1.4
- Argentina: 1.2
- Italy: 1.0
- Malawi: 0.8
- Rest: 0.03

### Fast growing countries in Seed market (USD Bn), basis CAGR (2000 to 2010)

- India: 12%
- United States: 8%
- China: 7%
- Germany: 7%
- France: 6%
- Brazil: 5%

Source: ISF Data 2013
Global Population will reach 9 bn by 2050 requiring twice the food to be produced from constant land area

- Need for productivity and increasing pressure on profit is putting pressure on sustainability

If world were to produce 2.5 times of current food, this is how the contributors will be

Current Crop Production  \[\text{Future Crop Production}\]

- **Breeding & Biotechnology**: 250%
- **Farm Practices**: 80%
- **Reduced Losses**: 50%
- **Land**: (-5%)
More production from less land can be accomplished only with combination of...

- Improved quality seeds
- Improved Seed replacement ratio: Shift from farm saved seeds to hybrids – increase productivity
- Combination traits to mitigate multiple stress factors: e.g. resilience to climate change
- Combining planting materials with “Traits” and technologies

- Increased input efficiency - Nutrients and water
- Increased Agrochemicals usage for crop protection
- Increased nitrogen use efficiency with reduced carbon footprint

- Improved farming practices – mechanization, land preparation, crop care and harvesting
- Increased pre & Post harvest care

Use of quality seeds alone could increase productivity by 15-20% - indicates the critical role of seed in agriculture....
What transformed the seed sector globally?

**Research & Development**
- Increased investment in R&D by private sector
- Combining discoveries in biology and information technology – sequencing – genomics selection and molecular breeding supported by high-throughput genotyping and phenotyping
- Few companies and public institutions engaged in gene discovery, providing access to major and minor genes to others for adoption in their germplasm

**Products**
- Rapid discoveries and conversion of discoveries to deliverables products
- Protection to gene discoveries through patenting accelerated corporate investment in gene discovery, complimenting public investment in crop genetics
- Growing use of hybrid seed with several technological components (e.g. seed coatings)

**Market and regulations**
- Growing international trade for fresh and processed food & FDI
- Trade and capital flows across countries
- Increasing number of favorable regulations
- Increasing number of multinational companies
Indian Seed Market
Indian Seed Market: Size

Indian Seed Industry growth over years (Value in USD Bn)

1990  0.13
2000  0.5
2010  1.7
2013  2.7

Indian Seeds Market by Value (2010)

1990s
Farm saved seed: 90%, Commercial seed: 10%
Public bred hybrids (18%), open pollinated varieties (68%), proprietary hybrids (14% of market value)

2000s
Farm saved seed: 75%, Commercial seed: 25%
Public bred hybrids (11%), open pollinated varieties (61%), proprietary hybrids (28% of market value 2000)

Source: Avendus Capital Study on “Sowing the seeds of success”, 2011
Department of Agriculture and Cooperation; Shiva & Crompton, 1998
### Indian Seed Market: Crop Profile

<table>
<thead>
<tr>
<th>Type</th>
<th>Market Value USD Bn (2010)</th>
<th>% of Total market Value</th>
<th>Growth %</th>
<th>What are they</th>
<th>Replacement Rate</th>
<th>Leading Players</th>
<th>R &amp; D Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varietal</td>
<td>0.19</td>
<td>12</td>
<td></td>
<td>Open-pollinated seeds which are saved over years for their desirable traits</td>
<td>20-80%</td>
<td>small regional players &amp; govt. agencies</td>
<td>Low</td>
</tr>
<tr>
<td>Hybrid</td>
<td>1.0</td>
<td>63</td>
<td>1-2%</td>
<td>Produced by artificially cross-pollinating plants; offer better characteristics over the parents</td>
<td>100%</td>
<td>Syngenta, Dupont, Mahyco, J K seeds, Bioseed, Rasi, Bayer</td>
<td>Medium</td>
</tr>
<tr>
<td>Genetically Modified (GM)</td>
<td>0.4</td>
<td>25</td>
<td>16-17%</td>
<td>Seeds whose genetic material has been altered using genetic engineering techniques</td>
<td>100%</td>
<td>Monsanto, Dupont, Syngenta, Rassi, Pioneer</td>
<td>High</td>
</tr>
</tbody>
</table>

- GM seeds growth is expected to shoot up with introduction of GM traits in Egg plant & corn
- GM seeds pulling the growth-curve for the seed industry with a CAGR of 15-20%
Indian Seed Market: Structure

**Public Sector**
- 99 ICAR research institutes
- 65 agricultural Universities (SAUs & DUs)
- 15 State Seed Corporation (SSC)
- National Seed Corporation (NSC)
- State Farms Corporation of India (SFCI)

**Private Sector**
- ~ 500 small & medium players
- ~ 50 large national & Multinational players
- Majority of them with own R & D Units
- Rest have technical tie-ups

**1990’s**
Overall market share – 40%
Major focus on **high volume, low value crop seeds**
E.g. – Rice, wheat
Productivity oriented research

**2000’s**
Overall market share – 24%
Focus on E.g. – Rice, wheat
Research for a-biotic stress resistance & involving high cost & investment

**2000’s**
Overall market share – 60%
Major focus on **high value, low volume crop seeds**
E.g. – vegetable
Research focus – Pest & disease resistance

Overall market share – 76%
Research focus – improved nutritional profile
Seed Value Chain: Stakeholders

- **International Development bodies**
  - Policy changes at national & international level

- **International Germplasm sources**
  - Technical tie-ups

- **Private Seed Companies**
  - Contract production

- **Private research firms**
  - Dedicated research & development

- **State Agriculture Universities & research Institute**
  - Control over seed trade & business

- **NSC & SSC**
  - Platform to address national seed industry concerns

- **National Seed Associations**

- **Private research firms & distributors**
  - Ensure timely supply of seed

- **Contract Seed Farmer**

- **Farmer’s cooperatives**

- **Farmer**

- **Seed Dealers & distributors**

- **Policy changes at national & international level**
Indian Seed Market: Growth over years & growth drivers

**Regulatory framework**
- Enactment of suitable legislations
- Market liberalization to increase availability of high-quality seeds to Indian farmers
- Relaxation of norms for export to overseas country

**Research & Technology**
- Sharing of germplasm and breeder seeds of public-bred varieties
- Minimum restrictions and proper safeguard mechanism for import of germplasm & hybrids/varieties
- Acceptance and commercialization of new seed technology, GM traits, use of biotechnology
- Investments by public/private players

**Foreign Investment**
- Technical and financial assistance in the early stage of development from foreign aid agencies such as USAID, Ford Foundation and Rockefeller Foundations, World Bank to strengthen the breeding, seed production, distribution, processing, and quality control infrastructure in public and private sectors
- Entry of multinational corporations into the Indian seed business through equity participation

**Environment**
- Public-private partnership
- Special schemes for upgrading quality of farm saved seed and improving Seed Replacement Rate
- Extension programs for awareness generation and easy accessibility of quality inputs
- Introduction of the Seed Technology subject at graduate and Post graduate level

*Source: Avendus Capital Study on “Sowing the seeds of success”, 2011*  
*Department of Agriculture and Cooperation; Shiva & Crompton, 1998*
From Challenges to Robust Growth

Challenges Faced

- Inadequate supply of seed
- Limited range of crops
- Poor quality and Poor yielding varieties
- Use of farm saved seed
- High susceptibility to pest and disease, erratic monsoon
- Lack of extension
- Isolated from market service

Interventions

**Product related:**
- Focus on seed quality improvement
- Various news channels & broadcasting’s focusing on importance of quality seed
- Investment in R & D at research institutes
- Community gene Banking and on farm conservation of germplasm

**Market related:**
- Model Seed Village program
- Encouragement to private sector to work with small farmer
- Developing market for agriculture produce

**Government:**
- Establishment of National seed corporations and state seed corporations
- Krishi Vighyan Kendras – extension services
- Focus on agriculture education

Impact

- Improved Seed Replacement Ratio and Improved yields
- Wide range of crop options
- Market oriented crop cultivation
- Quality up gradation of farmer saved seed
- Farmer cooperatives formation for seed production
- Contract seed production with private player
- Cultivation of exotic crops for export
- Increased income for farmers
Product related Intervention: *Quality seed supply is one of the important factors driving increased agricultural production in India*

<table>
<thead>
<tr>
<th>Year</th>
<th>Food Grain Production (Million Tonnes)</th>
<th>Cotton production (Million Bales)</th>
<th>Oil Seed Production (Million Tonnes)</th>
<th>Quality Seeds distributed (Million Qtls)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51</td>
<td>50.82</td>
<td>3.04</td>
<td>5.16</td>
<td>-</td>
</tr>
<tr>
<td>1960-61</td>
<td>82.02</td>
<td>5.6</td>
<td>6.98</td>
<td>-</td>
</tr>
<tr>
<td>1970-71</td>
<td>108.42</td>
<td>4.76</td>
<td>9.63</td>
<td>0.5</td>
</tr>
<tr>
<td>1980-81</td>
<td>129.59</td>
<td>7.01</td>
<td>9.37</td>
<td>3.5</td>
</tr>
<tr>
<td>1990-91</td>
<td>176.59</td>
<td>9.84</td>
<td>18.61</td>
<td>5.71</td>
</tr>
<tr>
<td>2000-01</td>
<td>195.93</td>
<td>9.65</td>
<td>18.4</td>
<td>8.54</td>
</tr>
<tr>
<td>2011-12</td>
<td>259.32</td>
<td>35.2</td>
<td>28.82</td>
<td>40.0</td>
</tr>
</tbody>
</table>

- Import of high yielding varieties & breeding lines
- Breeding programs for Hybrids & transgenic crops: Cereals, millets, vegetables,
- Investment in R & D by private sector – 10 to 12% of total revenue
- Technical tie-ups for sourcing high value germplasm
- Public-Private partnership for high end products & their commercialization
- Consolidation of private firms for high cost technology development

**Model Seed Village**
- A village, wherein trained group of farmers are involved in production of seeds of various crops and cater to the needs of themselves, fellow farmers of the village and farmers of neighboring villages in appropriate time and at affordable cost
- Quality Seed supply from public & private sector
- Farmer Capacity building
- Establishing seed processing unit
## Impact: Increased production and yield over years

<table>
<thead>
<tr>
<th>Year</th>
<th>Rice</th>
<th>Wheat</th>
<th>Maize</th>
<th>Oilseeds</th>
<th>Pulses</th>
<th>Rice</th>
<th>Wheat</th>
<th>Maize</th>
<th>Oilseeds</th>
<th>Pulses</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002-03</td>
<td>71.8</td>
<td>65.8</td>
<td>11.2</td>
<td>14.8</td>
<td>11.1</td>
<td>1744</td>
<td>2612</td>
<td>1681</td>
<td>691</td>
<td>543</td>
</tr>
<tr>
<td>2003-04</td>
<td>88.5</td>
<td>72.2</td>
<td>15.0</td>
<td>25.2</td>
<td>14.9</td>
<td>2078</td>
<td>2713</td>
<td>2041</td>
<td>1064</td>
<td>635</td>
</tr>
<tr>
<td>2004-05</td>
<td>83.1</td>
<td>68.6</td>
<td>14.2</td>
<td>24.4</td>
<td>13.1</td>
<td>1984</td>
<td>2602</td>
<td>1907</td>
<td>885</td>
<td>577</td>
</tr>
<tr>
<td>2005-06</td>
<td>91.8</td>
<td>69.4</td>
<td>14.7</td>
<td>28.0</td>
<td>13.4</td>
<td>2102</td>
<td>2619</td>
<td>1938</td>
<td>1004</td>
<td>598</td>
</tr>
<tr>
<td>2006-07</td>
<td>93.4</td>
<td>75.8</td>
<td>15.1</td>
<td>24.3</td>
<td>14.2</td>
<td>2131</td>
<td>2708</td>
<td>1912</td>
<td>916</td>
<td>612</td>
</tr>
<tr>
<td>2007-08</td>
<td>96.7</td>
<td>78.6</td>
<td>19.0</td>
<td>29.8</td>
<td>14.8</td>
<td>2202</td>
<td>2802</td>
<td>2335</td>
<td>1115</td>
<td>625</td>
</tr>
<tr>
<td>2008-09</td>
<td>99.2</td>
<td>80.7</td>
<td>19.7</td>
<td>27.7</td>
<td>14.6</td>
<td>2178</td>
<td>2907</td>
<td>2414</td>
<td>1006</td>
<td>659</td>
</tr>
<tr>
<td>2009-10</td>
<td>89.1</td>
<td>80.8</td>
<td>16.7</td>
<td>24.9</td>
<td>14.7</td>
<td>2125</td>
<td>2839</td>
<td>2024</td>
<td>958</td>
<td>630</td>
</tr>
<tr>
<td>2010-11</td>
<td>96.0</td>
<td>86.9</td>
<td>21.7</td>
<td>32.5</td>
<td>18.2</td>
<td>2239</td>
<td>2989</td>
<td>2540</td>
<td>1193</td>
<td>691</td>
</tr>
<tr>
<td>2011-12</td>
<td>105.3</td>
<td>94.9</td>
<td>21.6</td>
<td>30.0</td>
<td>19.1</td>
<td>2393</td>
<td>3177</td>
<td>2476</td>
<td>1133</td>
<td>699</td>
</tr>
</tbody>
</table>

| % Change | 47%   | 44%   | 93%   | 103%    | 72%    | 37%   | 22%   | 47%   | 64%      | 29%    |
Product related Intervention: Quality certification standards

Seed Certification standards

General Seed Certification standards

Specific crop standards

Field standards

Specific seed standards

Purity analysis
- Pure seed (min.)
- Inert matter (max.)
-- Other crop seed (max.)
  a) Weed seeds (max.)
  b) Objectionable weed seeds
  c) Germination (min.)
  d) Moisture content (Ord. & VP)

a) Land requirement
b) Minimum isolation distance
c) Inspections
d) Minimum specific crop standards- off types
Diseases
OBW
Inseperable crop plants

Pure Seed
Other crop seed
Objectionable weed seed
Inert matter
## Product related Intervention: Quality certification standards

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Wheat</th>
<th>Paddy</th>
<th>Barley</th>
<th>Maize</th>
<th>Sorghum</th>
<th>Pearl millet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure seed (min.)</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>Inert matter (max.)</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Other crop seed (OCS) (max.)</td>
<td>10 / kg</td>
<td>20 / kg</td>
<td>10 / kg</td>
<td>20 / kg</td>
<td>10 / kg</td>
<td>20 / kg</td>
</tr>
<tr>
<td>Total Weed seeds</td>
<td>10 / kg</td>
<td>20 / kg</td>
<td>10 / kg</td>
<td>20 / kg</td>
<td>10 / Kg</td>
<td>20 / Kg</td>
</tr>
<tr>
<td>Obj. weed seeds (max.)</td>
<td>2 / kg</td>
<td>5 / kg</td>
<td>2 / kg</td>
<td>5 / kg</td>
<td>10 / kg</td>
<td>20 / kg</td>
</tr>
<tr>
<td>Germination (incl. H.S)</td>
<td>85</td>
<td>85</td>
<td>80</td>
<td>80</td>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td>Moisture (max.)</td>
<td>12.0</td>
<td>12.0</td>
<td>13.0</td>
<td>13.0</td>
<td>12.0</td>
<td>12.0</td>
</tr>
<tr>
<td>Vapour proof</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

*F.S – Foundation seed  
C.S – Certified seed*
Product related Intervention: *SRR improvement*

**Growth of SRR in India**

- SRR over a decade has almost doubled for most of the crops
- Vegetable seed opportunity witnesses high replacement of varieties to hybrids

- Seed Quality regulations to avoid chances of spurious seed business
- Seed village program to strengthen & improve farm saved seed quality
- Voluntary certification
- Distribution channel establishment to improve seed availability
- Awareness programs by Krishi Vigyan Kendra’s and Agriculture Extension officials
## Product related Intervention: SRR improvement

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Crop</th>
<th>India SRR %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wheat</td>
<td>30</td>
</tr>
<tr>
<td>1</td>
<td>Paddy</td>
<td>27</td>
</tr>
<tr>
<td>2</td>
<td>Maize</td>
<td>48</td>
</tr>
<tr>
<td>3</td>
<td>Sorghum Variety (Hybrid)</td>
<td>13.5 (100)</td>
</tr>
<tr>
<td>4</td>
<td>Pearl millet Variety (Hybrid)</td>
<td>98 (100)</td>
</tr>
<tr>
<td>5</td>
<td>Bengal gram</td>
<td>20.97</td>
</tr>
<tr>
<td>6</td>
<td>Black Gram</td>
<td>50.82</td>
</tr>
<tr>
<td>7</td>
<td>Green Gram</td>
<td>35.12</td>
</tr>
<tr>
<td>8</td>
<td>Red Gram</td>
<td>30.74</td>
</tr>
<tr>
<td>9</td>
<td>Groundnut</td>
<td>5.76</td>
</tr>
<tr>
<td>10</td>
<td>Soybean</td>
<td>57.76</td>
</tr>
<tr>
<td>11</td>
<td>Sunflower variety (Hybrid)</td>
<td>45 (94)</td>
</tr>
<tr>
<td>12</td>
<td>Cotton variety (Hybrid)</td>
<td>61 (100)</td>
</tr>
</tbody>
</table>

- Use of Farm saved seed is common in even India
- High prices of seeds force farmer to use his own seed
- Government efforts to improve quality of farm saved seed would include –
  - Providing quality pedigree variety seed
  - Training on selection, multiplication, treatment & storage of seed
  - Encouraging community based seed production
  - encouraging seed replacement at regular interval
Government Interventions

**Associations & Agencies**
- ICAR, ICRISAT, IARI
- National Seed Corporation (NSC): Main certification body to provide foundation & certified seed to farmers
- State Seed Corporations (SSC): Regulate seed market across regions
- **Seed testing & certification**: 108 laboratories and 2 central laboratories in the country
- National Seed Research and Training Centre

**Policy & Regulatory**
- **Seed Act**: To regulate quality of seeds by regulations for Labeling & voluntary certification for purity, germination %
- Liberalization of FDI norms: Encouragement to MNCs (Monsanto, Bayer, BASF etc. to enter in seed sector
- Import of high quality seeds & germplasm allowed
- **Seed Bill**: Stimulate investment in R&D, Strengthening of India Patent act to protect both product and process
- **Subsidies** on seed to farmers

**Infrastructure**
- **National Seed Program (World Bank)**: Capacity building for seed research, production, processing & marketing: Training & technical assistance
- Strengthening plant quarantine framework
- National Mission on Agricultural Extension and Technology (NMAET)
- Warehousing Development and Regulatory Authority (WDRA)
- Financial support to farmers: Microfinance, Loans
Other Interventions

- **Public Private Partnerships**
  - **Conventional breeding:**
    - Basic Germplasm improvement
    - Development of inbred lines
    - Development of Hybrids
    - Seed production & marketing

- **Biotechnology:**
  - Transgenics
  - Molecular marker technologies (no bio-safety involved)
    - Discovery research
    - Technology development
    - Biosafety evaluation / deregulation
    - Breeding & product development
    - Seed production & marketing

- **Agriculture Education System**
  - ~50 SAUs for quality assurance in agricultural education – International linkages
  - Courses with emphasis on hands-on training, experiential learning for skill development
  - ~ 250 Experiential learning centers, ICT supported teaching
  - Farmer trainings
Platform for India-Africa Partnership in Agriculture (PIAPA)

ICRISAT South-South Initiative (IS-SI)
- ICAR and ICRISAT with partners from private institutions
- For focused and systematic international partnerships critical for a more effective and inclusive development cooperation between India and Africa
- Better policies, more effective institutions, improved infrastructure, and better access to markets and to high quality inputs particularly for dry-land farmers in India and Africa.

The IS-SI activities at ICRISAT will be executed through four major programs:

- High yielding pearl millet hybrids from India
- High iron and zinc bio-fortified sorghum breeding lines
- Soil-test based nutrient amendment with micro-nutrients
- Knowledge sharing platforms for providing research results
- ICT & innovative extension systems from India programs to Africa
- Training & capacity building scientists, faculty, extension agents, student, farmers
- Scholarships to PG and PhD students

Public private Partnership to establish:
- Agribusiness incubators in agricultural universities & research institutes
  - Focus on specific crop value chain

http://www.is-si.icrisat.org/
Cornell Sathguru would like to engage with you through
the AIP - Malawi initiative to build

A VIBRANT SEED SYSTEM IN MALAWI!