The Changing Face of Indian Seed Sector: Challenges and Opportunities

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The Green Revolution

Cradles of Success:

• Policy Support
• Institutions & Human Resource
• Global Partnership
  (ICAR with CIMMYT and IRRI)
• Extension System and Progressive Farmers
Impact of Green Revolution

• Five & half fold increase in food grains
  (50mt – 284.8 mt in 2018)
  - As against four fold increase in population
    (from 0.3 – 1.34 Billion)
  • Reduced poverty (From 70% - 20%)
• Buffer stock : > 46 mt ; Export : around 20 mt
  • Life expectancy almost doubled
    (From 32 - 68 years)
Green Revolution was Seed Led

Plant Type

Irrigated Wheat

Deep water rice

Salt tolerant rice
Prior to 1960
1885: First Seed Company, Namdeo Umaji, Mumbai
1916: Supply of quality vegetable seeds by M/s. Sutton and Sons at Kolkata, India
1925: Royal Commission on Agriculture
1957: First AICRP on Maize

Journey so far..
Key Milestones

Prior to 1960

1960’s
1963: National Seed Corporation
1966: Seed Act
1969: Seed Rules
1969: HYVP

1970’s
- 1972: National commission on Agriculture
- 1970s- Private sector

1980’s
- 1980s- Rapid growth of private sector
- 1990s- More focus

Source: NSAIdata

2000 Onwards
- 2001: PVPFR Ac t
- 2002: GM crops commercialization
Seed Related Legislations/Policies:

- **Seed Act, 1966**
  - Compulsory labeling and voluntary certification
  - Focus on seed quality regulation
  - To cover notified crops and varieties

- **Seed Control Order, 1983**
  - License for selling, exporting and importing seeds
  - Powers to State Governments to regulate seed trade under EC Act, 1955

- **New Policy on Seed Development, 1988**
  - Encouraging commercial seed production by private sector
  - Import of vegetable and flower seeds under OGL
  - Time-bound Plant quarantine/Post entry quarantine system
  - FDI permitted in seed sector since 1987

- **Seed Bill 2004 (to be legislated)**
  - Compulsory registration of seed offered for sale
  - Compulsory disclosure of performance
  - National Seed Registry

National Commission on Agriculture (1972) - Role of private seed sector
Institutions

- ICAR Institutes - 102
- State Agricultural Universities - 71 (SAU and CAU)
- All India Coordinated & Network Projects - 89
- Krishi Vigyan Kendras - 720
- National Seed Corporation
- State Seed Corporations - 17
- State Seed Certification Agencies - 25

Private Seed Companies - 500 small and 50 big (including MNCs)

Indian Society of Seed Technology (1971)
Indian Institute of Seed Science
(Role in Breeder Seed Production & Seed Technology Research)

AICRP

• Breeder seed production as per DAC&FW indents (41 centres)
• Seed technology research (24 Centres)
• Capacity building

ICAR Seed Project

• Quality Foundation/Certified seed production (63 Centres)
• Strengthening of seed infrastructure
• To promote seed entrepreneurship
• Capacity building
Trend in Breeder Seed Production (> Four Times Increase in 20 Years)

Source: IISS, Mau
Seed for Food Security

Availability of Quality/Certified Seed in India (around 40 m q)

Source: Directorate of Economics & Statistics, Ministry of Agriculture, GOI

Per Seed More Yield

Trend of Food Grains, Oilseeds and Pulses Production (m t)
Indian Seed System

Broad Categories

Formal system
- Public Sector
  - NSC
  - SSCs
  - ICAR/SAU’s
- Private Sector
  - Seed companies
  - Retailers

Informal system
- Farmer saved seeds

MIXED
Private Seed Sector in India

- Around 550 Seed Companies
- 15% - R&D, Production and Marketing
- 20% - Production and Marketing
- 65% - Marketing
Challenges
Bridging Yield Gap by Increasing SRR

<table>
<thead>
<tr>
<th>Crop</th>
<th>SRR in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundnut</td>
<td>23</td>
</tr>
<tr>
<td>Soybean</td>
<td>53</td>
</tr>
<tr>
<td>Tur</td>
<td>22</td>
</tr>
<tr>
<td>Gram</td>
<td>19</td>
</tr>
<tr>
<td>Jowar</td>
<td>24</td>
</tr>
<tr>
<td>Bajra</td>
<td>60</td>
</tr>
<tr>
<td>Wheat</td>
<td>33</td>
</tr>
<tr>
<td>Paddy</td>
<td>40</td>
</tr>
<tr>
<td>Maize</td>
<td>57</td>
</tr>
<tr>
<td>Mustard</td>
<td>79</td>
</tr>
<tr>
<td>Vegetable</td>
<td>85</td>
</tr>
<tr>
<td>Cotton</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: DACFW, GOI
Challenges Before Seed Industry

- Climate change: Impact on seed production and quality
- Incentives on sale of fortified seeds – ex. QPM
- Needed policy support – IPR on innovation
- Policy on GM seeds, long awaited approvals
- Pricing control on seeds?
- Testing protocols & standards for organic seeds
- Fear of mergers and acquisition of small companies
Rice
Significant reductions in yield and quality of rice in southern Japan.

Fruits
Fruit qualities have changed, example coloring
Temperature rise has forced apple cultivation to
Shift to higher elevation

Vegetables
Reductions in the growing periods of leafy and root vegetables

Impact of Climate Change - Japan

Clouding of rice

Tanning of apple
Bt Cotton - A Great Success Story

- In India, the area under Bt cotton reached between 11-12 mha (nearly 95% coverage)
- The cotton production has tripled (2.3 to 6.1 mt)
- Pesticide consumption reduced by 40 %
- Income of 5 million cotton farmers increased by US $ 100 to 300/ha
- Export of cotton fetching US $3.5 billion

CONCERNS:
- Issue of licensing
- Pricing of seed
- Release of new events?
Opportunities
Why to Invest in India?

- Robust Demand: A large population and rising urban and rural incomes are driving the demand, while external demand is driving the increase in agriculture exports from India.

- Attractive Opportunities: Demand for agricultural inputs and allied services like warehousing and cold storages is increasing in India at a fast pace.

- Policy Support: Schemes like Paramparagat Krishi Vikas Yojana help in developing organic clusters and make available chemical-free inputs to farmers. Government of India is also aiming to double farmers’ income by 2022.

- Competitive Advantage: High proportion of agricultural land, diverse agro-climatic conditions encourage cultivation of different crops.

Source: https://www.ibef.org/industry/agriculture-india.aspx
Indian Seed Market

- Fast growth rate over two decades: 10-14%
- Current Value - US $ 2.6 billion
- Expected by 2020 - US $ 3.0 billion
- Expected by 2030 - US $ 5.0 billion
## Crop wise Seed Market in India

<table>
<thead>
<tr>
<th>Crop</th>
<th>Market 2018 (Rs Cr)</th>
<th>Estimated Market 2022 (Rs Cr)</th>
<th>CAGR</th>
<th>Key Players</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetables</td>
<td>4500</td>
<td>6300</td>
<td>8%</td>
<td>BASF, Seminis, Syngenta, Mahyco, VNR, Namdhari, Indo American, Accen HyVeg, Advanta</td>
</tr>
<tr>
<td>Cotton</td>
<td>3000</td>
<td>3500</td>
<td>6%</td>
<td>Rasi, Kaveri, Nuziveedu, Mahyco, Ajit, Shriram Bioseed, Ankur, Seedworks, Tierra, Metahelix</td>
</tr>
<tr>
<td>Maize</td>
<td>2400</td>
<td>3100</td>
<td>10%</td>
<td>Corteva, Bayer Monsanto, Syngenta, Shriram Bioseed, Kaveri, Limagrain, Rasi</td>
</tr>
<tr>
<td>Rice</td>
<td>2200</td>
<td>2900</td>
<td>8%</td>
<td>Bayer Monsanto, Corteva, VNR, Mahyco, Syngenta, Savannah, Metahelix, Rasi</td>
</tr>
<tr>
<td>Others</td>
<td>5900</td>
<td>9200</td>
<td>9%</td>
<td>Advanta, Crystal, Corteva, Bayer Monsanto, Metahelix</td>
</tr>
<tr>
<td>Total</td>
<td>18000</td>
<td>25000</td>
<td>10%</td>
<td></td>
</tr>
</tbody>
</table>
Indian Vegetable Seed Market (2018)
(Around 25% of total)

Total hybrid seed value
30,000 millions

Total OP seed value
15,000 millions

5-7% annual growth

66% Hybrids & 34% Varieties
<table>
<thead>
<tr>
<th>Company</th>
<th>Size (Million)</th>
<th>Key market segments</th>
<th>Key Strengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaveri Seeds</td>
<td>11,000</td>
<td>Cotton, Maize, Rice</td>
<td>Research, Cotton products, Brand image, Seed production</td>
</tr>
<tr>
<td>Nuziveedu Seeds</td>
<td>9,000</td>
<td>Cotton, Maize, Rice</td>
<td>Cotton Products, Brand image, all India presence, seed production</td>
</tr>
<tr>
<td>DuPont Pioneer</td>
<td>10,000</td>
<td>Maize, Rice, Mustard, Bajra</td>
<td>Research, Global strengths, Marketing, Seed production</td>
</tr>
<tr>
<td>Bayer Monsanto</td>
<td>9,000</td>
<td>Cotton, Maize, Rice, Bajra, Vegetables</td>
<td>Research, Global strengths, Marketing, Seed production</td>
</tr>
</tbody>
</table>
Improvement in rice productivity (kg/ha/yr)

<table>
<thead>
<tr>
<th>Period</th>
<th>Most distinguishing feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase-I</td>
<td>Selection in traditional varieties and hybridization between indica and japonica types was also attempted</td>
</tr>
<tr>
<td>1950-1966</td>
<td></td>
</tr>
<tr>
<td>Phase-II</td>
<td>Dwarf and semi-dwarf rice varieties</td>
</tr>
<tr>
<td>1967-1983</td>
<td></td>
</tr>
<tr>
<td>Phase–III</td>
<td>Development of cultivars with adaptation to niche specific environments</td>
</tr>
<tr>
<td>1984-2000</td>
<td></td>
</tr>
<tr>
<td>Phase–IV</td>
<td>Incorporation of multiple genes for resistance to diseases and tolerance to abiotic stresses like submergence and drought</td>
</tr>
<tr>
<td>2001-2017</td>
<td></td>
</tr>
</tbody>
</table>

Source: Yadav, Singh, Dhillon & Mohapatra 2019
Per cent growth rate in productivity
<table>
<thead>
<tr>
<th>Country</th>
<th>Crop</th>
<th>Area under Hybrid (mha)</th>
<th>Total Area (mha)</th>
<th>% of total area under Hybrid</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>Rice</td>
<td>2.9</td>
<td>43.85</td>
<td>7</td>
<td>2015</td>
</tr>
<tr>
<td>India</td>
<td>Maize</td>
<td>5.6</td>
<td>9.3</td>
<td>60</td>
<td>2015</td>
</tr>
<tr>
<td>India</td>
<td>Sorghum</td>
<td>1.5</td>
<td>5.3</td>
<td>28</td>
<td>2015</td>
</tr>
<tr>
<td>India</td>
<td>Bajra</td>
<td>7.1</td>
<td>40</td>
<td></td>
<td>2015</td>
</tr>
<tr>
<td>India</td>
<td>Cotton</td>
<td>12</td>
<td>12.8</td>
<td>94</td>
<td>2015</td>
</tr>
<tr>
<td>India</td>
<td>Sunflower</td>
<td>0.46</td>
<td>0.59</td>
<td>78</td>
<td>2015</td>
</tr>
<tr>
<td>India</td>
<td>Arhar</td>
<td>?</td>
<td>3.7</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>Castor</td>
<td>1.04</td>
<td></td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>Rapeseed Mustard</td>
<td>0.6</td>
<td>5.8</td>
<td>10</td>
<td>2015</td>
</tr>
<tr>
<td>China</td>
<td>Rice</td>
<td>19</td>
<td>30.9</td>
<td>61</td>
<td>2015</td>
</tr>
<tr>
<td>China</td>
<td>Maize</td>
<td>26</td>
<td>37.1</td>
<td>70</td>
<td>2015</td>
</tr>
<tr>
<td>China</td>
<td>Sorghum</td>
<td>0.3</td>
<td>0.5</td>
<td>60</td>
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<tr>
<td>China</td>
<td>Cotton</td>
<td>1</td>
<td>5.3</td>
<td>19</td>
<td>2015</td>
</tr>
<tr>
<td>China</td>
<td>Sunflower</td>
<td>0.684</td>
<td>0.95</td>
<td>72</td>
<td>2015</td>
</tr>
<tr>
<td>China</td>
<td>Rapeseed Mustard</td>
<td>5</td>
<td>7.59</td>
<td></td>
<td>2015</td>
</tr>
</tbody>
</table>

Source: [www.indiaagristat.com](http://www.indiaagristat.com); [http://ricepedia.org/china](http://ricepedia.org/china); [https://www.statista.com](https://www.statista.com); Google Books
Single Cross Maize Hybrids

- In one decade (2001-2011) - Maize production doubled (10-22 mt)
- The productivity increased by 80% (1.5-2.5 t/ha)
- Maize has shown fastest growth rate (around 4%)
- Maize production can further be doubled in next one decade
- Hybrid coverage to be increased from 60 to >90%
HarvestPlus:
Biofortified crops released in **30 countries**
Opportunities to Harness

- Farmers’ acceptance of quality seed, especially the hybrids is very high
- Scope exists to increase SRR under new varieties/hybrids
- Increase in area under Hybrids:
  (Cotton 95%, Vegetables 70%, Corn 50%, Rice 5%)
- Genome editing be another option vis-à-vis GM crops
- Potential for higher R&D investments by Private Sector
- Considerable scope for global seed market (almost 5 times in next decade)
Global Seed Industry (2018) – US $ 66.9 billion

- **Conventional Seed**
  - Corn
  - Sunflower
  - Canola
  - Rice
  - Wheat
  - Sorghum
  - Soybeans
  - Vegetables
  - $ 32.6b

- **GM Seed**
  - Corn
  - Soybeans
  - Cotton
  - Canola
  - Sugarbeet
  - Vegetables
  - $ 34.3b

- Expected to grow at 6.6% to around US$ 98.1 Billion by 2024
- Indian seed market valued at USD 2.6 billion currently (4.0%)

Source: https://www.imarcgroup.com
International Seed Trade

US $ 10 billion

• Leading Exporters:
  France, Netherlands, Germany : 50 %
  USA : 25 %
  Others : 25 %

• Share of China : 6 %
• Share of India : Just 1 % (Scope to increase)

There exists good potential for seed export
ISTA: Suggestions for Consideration

1. Membership fee for institutions in developing countries and for small seed companies be revisited (only 19 in India?)
2. All Species from the region need to be covered e.g., Papaya, Taro, Ash Gourd, etc.
3. A regional office of ISTA could be established in Asia
4. Access to information on ISTA mobile App
5. Accreditation process be shortened (currently only 6 labs. In India)
6. Representation of private sector on ISTA executive body
7. ISTA manuals be made available online
Additional Suggestions

- Development of crop/variety specific testing protocols
- Development of automated detection of seed maturity
- Development of global weed seed atlas
- Revisiting the validity periods for seed storage
- PRA - Inclusion/exclusion of designated diseases
- Establishment of good seed testing laboratories
- Revisiting Minimum Seed Standards, due to climate change
- DNA fingerprinting and DUS to implement PPV&FRA
- Establishment of community seed banks
- Building competent human resource
The Way Forward

- Need for Separate Seed Technology Mission
- Urgency for Revision of Seed Act, 1966
- Regulatory System for TFL Seed?
- Public Private Partnership – Providing an Enabling Environment
- Creation of National Seed Export Council – Long Term Policy on Export
- Sharing Germplasm – ABS?
- System of Traceability, PRA and Plant Quarantine
- Building Cooperation – National/Regional/International level
- Building Mutual Trust and Understanding
Thank You!